To the throng of eager questioning brothers and sisters in the art of bee culture, in our own and other countries, this work is especially dedicated by THE AUTHORS.

THE A B C and X Y Z OF BEE CULTURE

A Cyclopedia of Everything Pertaining to the Care of the Honey-bee; Bees, Hives, Honey, Implements, Honey-plants, etc. Facts Gleaned from the Experience of Thousands of Beekeepers, and Afterward Verified in Our Apiary.

By A. I. and E. R. Root

146th Thousand

MEDINA, OHIO
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1877 Preface

In preparing this work I have been much indebted to the books of Langstroth, Moses Quinby, Prof. A. J. Cook, King, and some others, as well as to all the bee-journals; but, more than to all these, have I been indebted to the thousands of friends scattered far and wide who have so kindly furnished the fullest particulars in regard to all the new improvements as they have come up in our beloved branch of rural industry. Those who questioned me so much a few years ago are now repaying by giving me such long kind letters in answer to any inquiry I may happen to make that I often feel ashamed to think what meager answers I have been obliged to give them under similar circumstances. A great part of this A B C book is really the work of the people; and the task that devolves on me is to collect, condense, verify, and utilize what has been scattered through thousands of letters for years past. My own apiary has been greatly devoted to testing carefully each new device, invention, or process as it came up. The task has been a very pleasant one; and if the perusal of the following pages affords you as much pleasure I shall feel amply repaid.

November, 1877. A. I. Root.

Preface to the 1913 Edition

A. I. Root was able to revise the first two or three editions of this work; but a rapidly increasing business, and interest in other matters, coupled with failing health, made it necessary for him to transfer the work of revising to his oldest son, the writer, who had just come out of school. At that time, 1885, we began to assume the management of Gleanings in Bee Culture, which furnishes material for the book. But as the years have rolled by, and the scope of the work increased, it has been necessary for us to call in the aid of others—those who are specialists along certain lines, for the reviser has felt that the reader of these pages should be given the very best and latest there is on any one particular subject. Among the list of editorial helpers to be mentioned first and foremost is Dr. C. C. Miller, the veteran comb-honey producer of 82 years—a man who bridges the past and the present. He is almost as well known in Europe as in America, and almost the only one left in the United States who can stand alongside of A. I. Root, the original author. We secured also the aid of another Miller, A. C., of Providence, Rhode Island, a banker by profession, but a close student in beekeeping. The latter thoroughly reread the previous edition, making many suggestions and changes here and there before we began work on this edition. A large number of these suggestions were adopted, and the matter incorporated in the text. His other comments, in which he may or may not differ with the author, will be found scattered all through this work in the form of footnotes under the initials "A. C. M." In a similar way will be found notes by Dr. C. C. Miller, signed "C. C. M." The unsigned footnotes are by the author and reviser. Mr. A. C. Millller, besides writing the general subject of "Bee Behavior" and "Observatory Hives," also read thoroughly the final proofs of this edition in collaboration with our office reader, Mr. W. P. Root.

At first thought when one glances over the new volume and observes that two-thirds or three-fourths of the matter was written by E. R. Root, he will wonder where A. I. Root

comes in, and whether it is a case of "Hamlet with Hamlet left out." This is not the case. Some of the best things that A. I. Root ever wrote on bees (and he wrote a good many) still appear in this volume, and always will. It is not so much because his writings have been stricken out of this edition, but because the immense amount of new stuff made necessary by the growth of the industry has made A. I. R.'s material seem small in comparison. His familiar style will be recognized, for example, in Absconding Swarms; After-swarms; Anger of Bees; Artificial Heat; Artificial Pasturage; Bee-hunting; Bee-moth; Italian Bees; Queens; Robbing; Stings. What he has written under these heads will always remain as classic in bee culture. No man had more enthusiasm in the study of bees than A. I. Root, and that enthusiasm is so conspicuous that his writings can usually be picked out of the other matter, even though they have been skillfully interwoven with matter written by others.

For over thirty years the A B C has been kept in standing type, so that it might be easy to keep it abreast with the times by simply changing the matter here and there in places so as to bring the old matter up to date. In 1912 we began the work of revising the present edition. We soon found that we should be compelled to discard the old type on which all previous editions had been printed, both because it was badly worn and because the contemplated changes would add so much new matter that it would not be practicable to continue the standing-type scheme. We purchased, mean time, a new and modern $4000 type-setting machine, or what is known as a model No. 8 book linotype, and reset the entire work. This machine now makes it possible for the publishers to handle their increasing business on other publications than The A B C and X Y Z of Bee Culture and GLEANINGS IN BEE CULTURE, a semi-monthly illustrated magazine. By having the old matter all reset we were enabled to make a more complete revision than we had ever undertaken before. The new volume is, therefore, new almost from cover to cover. To give the reader an idea of the old subjects entirely rewritten for this edition, the following is a list:

Dandelion; Foul Brood; Honey as a Food; Honeycomb; Honey-plants; Locust; Logwood; Observatory Hives; Orange; Palmetto; Partridge Pea; Wild Pennyroyal; Phacelia.

The following subjects were either reclassified from their former position, or are entirely new ones that have never before appeared in any edition.

Artificial Swarming; Bee Behavior; Bees Attacking Fruit; Beekeepers and Fruit-growing; Bees and Poultry; Bees and Truck-gardening; Bleaching Comb Honey; Bottling Honey; Development of Bees; Extracting-houses; Feeding Back; Feeding Outdoors; Gallberry; Grading Comb Honey; Granulated Honey; Magnolia; Mangrove, Black; Observatory Hives; Pollination of Flowers; Shipping-cases for Comb Honey; Specialty in Bees; Specific Gravity of Honey; Statistics Concerning the Bee and Honey Business; Sweet Clover; Ti-ti; Tupelo; Wild Cherry; Wild Sunflower; Wintering in the South.

In addition to all these, almost every article has had extensive additions, so that the entire work bears the crisp date of 1912 and 1913.

To assist the reader in finding the numerous cross-references we thought best to reclassify many subjects. For example, under the head of "Diseases of Bees" in the former edition, the two types of foul brood (American and European) in this edition are both comprised under one head—Foul Brood, while Diseases of Bees covers the minor maladies that affect our little friends. In the former edition Comb Honey covered the subjects of Bleaching Comb Honey, Grading Comb Honey, and Shipping Cases. The two last mentioned will now be found under their respective heads in their alphabetical order. Again, Extracted Honey comprised the subject of Honey in Liquid Form and Bottling Honey. The last name has now been put under a heading by itself. Under the head of Extracting and Extractors there appeared the general subject of Extractors and Extracting-houses. These for this edition have been put under their own heads. Pollen

is now divided up under the heads of Pollen and Pollination of Flowers; and in the same way Hives, Swarming, and Wintering have been split up under several headings.

The object of reclassifying, as above stated, was to facilitate reference. For instance, in order to find "Shipping Cases" in the former edition the reader was directed to Comb Honey, then after turning over twenty-two pages he would find Shipping Cases. Now he looks for Shipping Cases direct in its regular alphabetical order. In like manner he will find Grading Comb Honey, Pollination of Flowers, Extracting-houses, and so on, in their proper alphabetical order.

An important feature of the 1913 edition is the bee botany, which has been entirely rewritten and revised by John H. Lovell, of Waldoboro, Me., and Prof. Eugene G. Baldwin, of Deland, Fla. Mr. Lovell is an entomologist and a botanist, and last, but not least, he is a beekeeper. He has entirely rewritten the introductory botanical history of every plant mentioned in this work except those prepared by Professor Baldwin. As no single writer is more familiar with the extensive bee flora in Florida, that subject was given to him. Since Mr. Lovell was thoroughly familiar with the subjects of Pollen and the Pollenation of Flowers he made large additions to them.

The article on foul brood is nearly three times as long as that in the former edition. It was entirely rewritten, after consulting some of the best authorities on bee diseases in the country, and, after it was written, it was submitted to one of the best foul-brood inspectors in the United States. He wrote back, saying it was comprehensive and orthodox, and that he would like to get copies of it to give out, as he regarded it the most complete on the subject of any thing he had seen.

Comb Honey and Extracted both received large additions. The first of each subject is entirely rewritten.

Hundreds of new engravings have been added, so that, taking every thing into consideration, the reviser believes he is presenting to the public the largest and most comprehensive work on bees that has ever been printed in any language.

Last but not least, this edition has a complete index at the close of the work. The former index comprised only eight pages, while the new one covers thirteen pages.

All told, there are between three and four thousand references to aid the reader in finding just the information he desires.

These extensive changes and additions now make the present volume 750 double-column pages, which is just 150 pages more than appeared in the previous edition. The increased size of the present work has made it necessary to charge $2.00 instead of $1.50, as before. Ordinarily a volume of this size, containing the amount of matter that this does, is sold for $5.00; but as we have always maintained a popular price, we continue to do so now, preferring to make a small profit on a large sale rather than a big profit on a small sale.

So extensive has been the demand for it that it is now to be had in French and German, and large portions of it have been published in Russian and Spanish; and it is hoped, before two more years roll by, that there will be a complete edition of it in Spanish.

The reviser offers no apology for any lack of literary style, for much of the work of revision and the writing of new articles has been done under the pressure of other work. But he has endeavored to use the plainest and simplest language possible to describe each process, device, or method.

In order that the reader may trace out the authorship of the various articles, a list of them is appended on the next page, written by A. I. Root, those by the writer, those by A. I. and E. R. conjointly, those by W. K. Morrison, Dr. E. F. Phillips, Dr. C. C. Miller, John H. Lovell, and others.

May 1, 1913. E. R. Root.

PREFACE

Authorship of Articles in This Work

ARTICLES WRITTEN BY A. I. ROOT.

Age of Bees; Catnip; Milkweed; Rocky Mountain Bee-plant; Sourwood; Whitewood.

ARTICLES WRITTEN BY E. R. ROOT.

Alfalfa; Apiary; Artificial Fertilization; Artificial Swarming; Barrels; Basswood; Bee-space; Bees Attacking Fruit; Beekeeping and Fruit-growing; Bees and Poultry; Bees and Truck Gardening; Bees as a Nuisance; Bees on Shares; Bee-bread; Beginning with Bees; Bleaching Comb Honey; Bottling Honey; Box Hives; Buckwheat; Canada Thistle; Catclaw; Clover; Comb Foundation; Comb Honey; Contraction; Diseases of Bees; Dividing; Entrances to Hives; Extracting; Extracting-houses; Feeding and Feeders; Feeding Back; Feeding Outdoors; Foul Brood; Frames, Self-spacing; Frames, to Manipulate; Fruit-blossoms; Gloves for Handling Bees; Grading Comb Honey; Granulated Honey; Heartsease; Hermaphrodite Bees; Hibernation of Bees; Hive-making; Hives; Honey-dew; House-apiary; Honey Exhibits; Honey, Bottling; Huajilla; Increase; Introducing; Italianizing; Locality; Marigold; Migratory Beekeeping; Moving Bees; Nucleus; Organizations of Beekeepers; Overstocking; Poisonous Honey; Profits in Bees; Propolis; Queen-rearing; Record-keeping of Hives; Reversing; Rats; Sage; Scale Hive; Shipping Cases; Spreading Brood; Spring Dwindling; Spring Management; Statistics of Bees and the Honey Business; Sweet Clover; Transferring; Veils; Ventilation; Vinegar; Weight of Bees; Willow-herb; Wintering; Wintering in the South.

ARTICLES WRITTEN JOINTLY BY A. I. AND E. R. ROOT.

Absconding Swarms; After-swarming; Anger of Bees; Ants; Artificial Heat; Artificial Pasturage; Asters; Bee-hunting; Bee-moth; Bees; Drones; Enemies of Bees; Extracted Honey; Hybrids; Italian Bees; Horsemint; Laying Workers; Queens; Raspberries; Robbing; Stings; Swarming; Uniting; Water.

ARTICLES WRITTEN BY J. H. LOVELL.

Eucalyptus; Goldenrod; Honey-plants; Horehound; Inkberry; Locust; Mesquite; Mustard; Partridge Pea; Phacelia; Sumac; Sunflower; also the botanical history of most of the other plants.

ARTICLES WRITTEN BY PROF. EUGENE G. BALDWIN, DELAND UNIVERSITY, FLORIDA.

Gallberry; Magnolia; Mangrove, Black; Orange; Palmetto; Partridge Pea; Pennyroyal; Tupelo; Ti-ti; Wild Cherry.

Adulteration of Honey; Cane Sugar; Glucose; Honey; Sugar.—Prof. A. Hugh Bryan, Bureau of Chemistry, Washington, D. C.

Anatomy of the Bee.—Dr. R. E. Snodgrass, Bureau of Entomology, Washington, D. C.

Ants in the South; Bees, Stingless; Carpet Grass; Hives, Evolution of; Honey and its Colors; Nectar.—W. K. Morrison.

Bee Behavior; Observatory Hives.—Arthur C. Miller.

Beekeeping for Women.—Anna B. Comstock, Entomologist, Cornell University.

Campanula.—Leslie Burr.

Cotton.—Louis H. Scholl.

Development of Bees.—Dr. Jas. A. Nelson, Bureau of Entomology, Washington, D. C.

Eye, Compound; Parthenogenesis; Scent of Bees.—Dr. E. F. Phillips, Bureau of Entomology, Washington, D. C.

Glossary, by W. K. Morrison and Dr. C. C. Miller.

Honey as a Food.—Dr. C. C. Miller and H. H. Root.

Honeycomb.—Dr. C. C. Miller and A. I. Root.

Logwood.—Rev. George W. Phillips, formerly of Jamaica.

Out-apiaries.—Dr. C. C. Miller and E. R. Root.

Pollen and Pollination of Flowers.—A. I. Root, John H. Lovell, and E. R. Root.

Smoke and Smokers; Wax.—E. R. and H. H. Root.

The Picture Gallery.—W. P. Root.

Introduction to the First Edition

BY A. I. ROOT.

About the year 1865, during the month of August, a swarm of bees passed overhead where we were at work, and my fellow-workman, in answer to some of my inquiries respecting their habits, asked what I would give for them. I, not dreaming he could by any means call them down, offered him a dollar, and he started after them. To my astonishment, he, in a short time, returned with them hived in a rough box he had hastily picked up; and, at that moment, I commenced learning my A B C in bee culture. Before night I had questioned not only the bees but every one I knew, who could tell me any thing about these strange new acquaintances of mine. Our books and papers were overhauled that evening; but the little that I found only puzzled me the more, and kindled anew the desire to explore and follow out this new hobby of mine; for, dear reader, I have been all my life *much* given to hobbies and new projects.

Farmers who had kept bees assured me that they once paid, when the country was new, but of late years they were no profit, and everybody was abandoning the business. I had some headstrong views in the matter, and in a few days I visited Cleveland, ostensibly on other business, but I had really little interest in any thing until I could visit the bookstores and look over the books on bees. I found but two, and I very quickly chose Langstroth. May God reward and for ever bless Mr. Langstroth for the kind and pleasant way in which he unfolds to his readers the truths and wonders of creation to be found inside the bee-hive.

What a gold-mine that book seemed to me as I looked it over on my journey home! Never was romance so enticing—no, not even Robinson Crusoe; and, best of all, right at my own home I could live out and verify all the wonderful things told therein. Late as it was, I yet made an observatory hive and raised queens from worker eggs before winter, and wound up by purchasing a queen of Mr. Langstroth for $20.00. I should, in fact, have wound up the whole business, queen and all, most effectually, had it not been for some timely advice toward Christmas, from a plain practical farmer near by. With his assistance, and by the purchase of some more bees, I brought all safely through the winter. Through Mr. Langstroth I learned of Mr. Wagner, who, shortly afterward, was induced to recommence the publication of the *American Bee Journal,* and through this I gave accounts monthly of my blunders and occasional successes.

In 1867, news came across the ocean from Germany, of the honey-extractor; and by the aid of a simple home-made machine I took 1000 lbs. of honey from 20 stocks, and increased them to 35. This made quite a sensation, and numbers embarked in the new business; but when I lost all but 11 of the 35 the next winter, many said, "There! I told you how it would turn out."

I said nothing, but went to work quietly and increased the 11 to 48 during the one season, not using the extractor at all. The 48 were wintered entirely without loss, and I think it was mainly because I took care and pains with each individual colony. From the 48 I secured 6162 lbs. of extracted honey, and sold almost the entire crop for 25 cents per lb. This capped the climax, and inquiries in regard to the new industry began to come in from all sides. Beginners were eager to know what hives to adopt, and where to get honey-extractors. As the hives in use seemed very poorly adapted to the use of the extractor, and as the machines offered for sale were heavy and poorly adapted to the purpose, besides being "patented," there really seemed to be no other way before me than to manufacture

these implements. Unless I did this I should be compelled to undertake a correspondence that would occupy a great part of my time without affording any compensation of any account. The fullest directions I knew how to give for making plain simple hives, etc., were from time to time published in the *American Bee Journal;* but the demand for further particulars was such that a circular was printed, and, shortly after, a second edition; then another, and another. These were intended to answer the greater part of the queries; and from the cheering words received in regard to them it seemed that the idea was a happy one.

Until 1873 all these circulars were sent out gratuitously; but at that time it was deemed best to issue a quarterly at 25 cents per year, for the purpose of answering these inquiries. The very first number was received with such favor that it was immediately changed to a monthly at 75 cents. The name given it was *Gleanings in Bee Culture,* and it was gradually enlarged until, in 1876, the price was changed to $1.00. During all this time it has served the purpose excellently of answering questions as they came up, both old and new; and even if some new subscriber should ask in regard to something that had been discussed at length but a short time before, it is an easy matter to refer him to it or send him the number containing the subject in question.

When *Gleanings* was about commencing its fifth year, inquirers began to dislike being referred to something that was published half a dozen years before. Besides, the decisions that were then arrived at perhaps needed to be considerably modified to meet present wants. Now you can see whence the necessity for this A B C book, its office, and the place we propose to have it fill.

December, 1878. A. I. Root.

Introduction to the 1913 Edition

The Development of Bee Culture in the United States

BY E. R. ROOT.

Before the reader plunges into the subject-matter of this work he may be interested in knowing something of the early beginnings and the phenomenal growth of bee culture to its present stage of development. It will not be necessary to trace the early history of apiculture in foreign lands any more than to state that it was not until the invention of movable combs, handled in a very crude way, that the science of bee culture began to take any step forward; and it was not until a little later that the perfected frame of our own Father Langstroth was brought out that bee culture may be said to have assumed any commercial importance in this country.

In the early '50's bees were kept only in box hives, and in a very small and primitive way. A yield of ten or fifteen pounds of dirty chunk honey per skep was considered a good yield; but after the Langstroth invention, by which the brood-nest of the colony could be investigated and manipulated, yields of anywhere from thirty-five to seventy-five pounds per colony of beautiful honey were common averages, and one hundred or two hundred pounds of extracted nothing extraordinary; indeed, a single colony in a good locality has been known to furnish anywhere from four hundred to seven hundred pounds. While such an output per hive is extraordinary, it goes to show what was made possible through the Langstroth invention. So important was it that it may be truthfully said that the art of keeping bees was almost entirely revolutionized, not only in this country but in many parts of Europe as well.

In the early '60's the honey-extractor and comb foundation were brought out. These, together with the invention of the movable frame, lifted bee culture up to a plane where there was "money in it." Very soon a large number were keeping anywhere from fifty to one hundred colonies. Others began to have a series of out-apiaries running anywhere from five hundred to three thousand colonies. In the meantime bee-supply factories sprang up all over the United States. Thousands and thousands of queen-bees were reared and sent through the mails, to improve stock. Periodicals on bees came into existence; the old *American Bee Journal,* edited by the lamented Samuel Wagner, a contemporary of Langstroth, did much to expound the new principles in the early days of modern bee culture. Shortly after, *Gleanings in Bee Culture,* edited by A. I. Root, came into existence. A devoted follower of Langstroth, he threw his whole soul into the keeping of bees. So ardent was his enthusiasm that his little quarterly, and shortly after a monthly, grew amazingly; and, even after the editorial management was transferred from father to sons, as noted in the preface, it continued to grow until it now has a circulation of thirty thousand copies. It has passed from the stage of a small monthly to a dignified illustrated magazine issued twice a month.

The honey business continued to develop from small beginnings so that there was a total aggregate of from one hundred and fifty to one hundred and seventy-five million pounds of honey produced and marketed annually in the United States. These figures can scarcely be comprehended; but if this amount were all loaded into freight-cars it would make a solid trainload, without a break, something like fifty miles long. Some States, in good years, notably California, have been known to produce as much as five and even six hundred cars in a season. Other States will produce anywhere from one hundred to two

hundred; but in most of the Eastern States the amount produced is sold locally, so that it does not show up in carloads as it does in some of the Western States, particularly those in the alfalfa and mountain-sage districts; and it may be said that the amount of honey that is annually produced at the present time in the arid and mountainous districts is very small in comparison with what probably will be produced in years to come. The new irrigation projects, both State and national, will make room for immense acreages of alfalfa, and this will doubtless mean in the near future a trebling of the amount of this beautiful honey.

In addition to the large amount of literature on bees that is being distributed, there are numerous local and State bee-keepers' societies that hold bee conventions in various parts of the country, and some of these are affiliated with the National Bee-keepers' Association.

Besides these different organizations there have been held various field-day exhibitions in different parts of the country. A few years ago one held in Jenkintown, near Philadelphia, at the apiary belonging to the authors of this work, over a thousand people interested in bee culture were present to witness the various operations in the handling of bees.

But this is not all. So great has been the growth of the bee-keeping industry that even our national government is giving substantial recognition to the business. The Bureau of Entomology of the United States Department of Agriculture sets aside fifteen thousand dollars per annum for the study of apiculture. Some five or six trained experts are devoting their whole time to the study of bees, including one bacteriologist, who is giving his entire attention to the investigation of bee diseases. In addition to all this, many State agricultural colleges and experiment stations are giving more or less attention to the subject—so much so that bee culture has come to be recognized as one of the great national industries.

Honey is now found on the tables of nearly all of our best families. A large percentage of the cakes and cookies now manufactured by some of the extensive baking companies contain honey, for it has been found that honey is not only a sweetener but a preservative as well. As an indication of the large amount of honey used for the purpose, it may be interesting to note in this connection that the National Biscuit Company is said to have placed an order for one hundred cars of honey. We have also been informed that the independent bakers have formed an association to buy honey and other supplies. This organization buys for its members anywhere from ten to twenty-five carloads of honey at a time. Honey is also used in a large way by the makers of soft drinks. They require a sweet that has plenty of flavor, and honey fills the bill.

Beeswax, of which there are now annually hundreds of tons produced, is now used in the arts and sciences as it never was before; and while paraffine and ceresine have to a limited extent taken its place, yet there is a peculiar quality about the product from the hives that makes it far superior to these mineral waxes. The very fact that it can command two or three times the price of its inferior competitors gives some idea of its value.

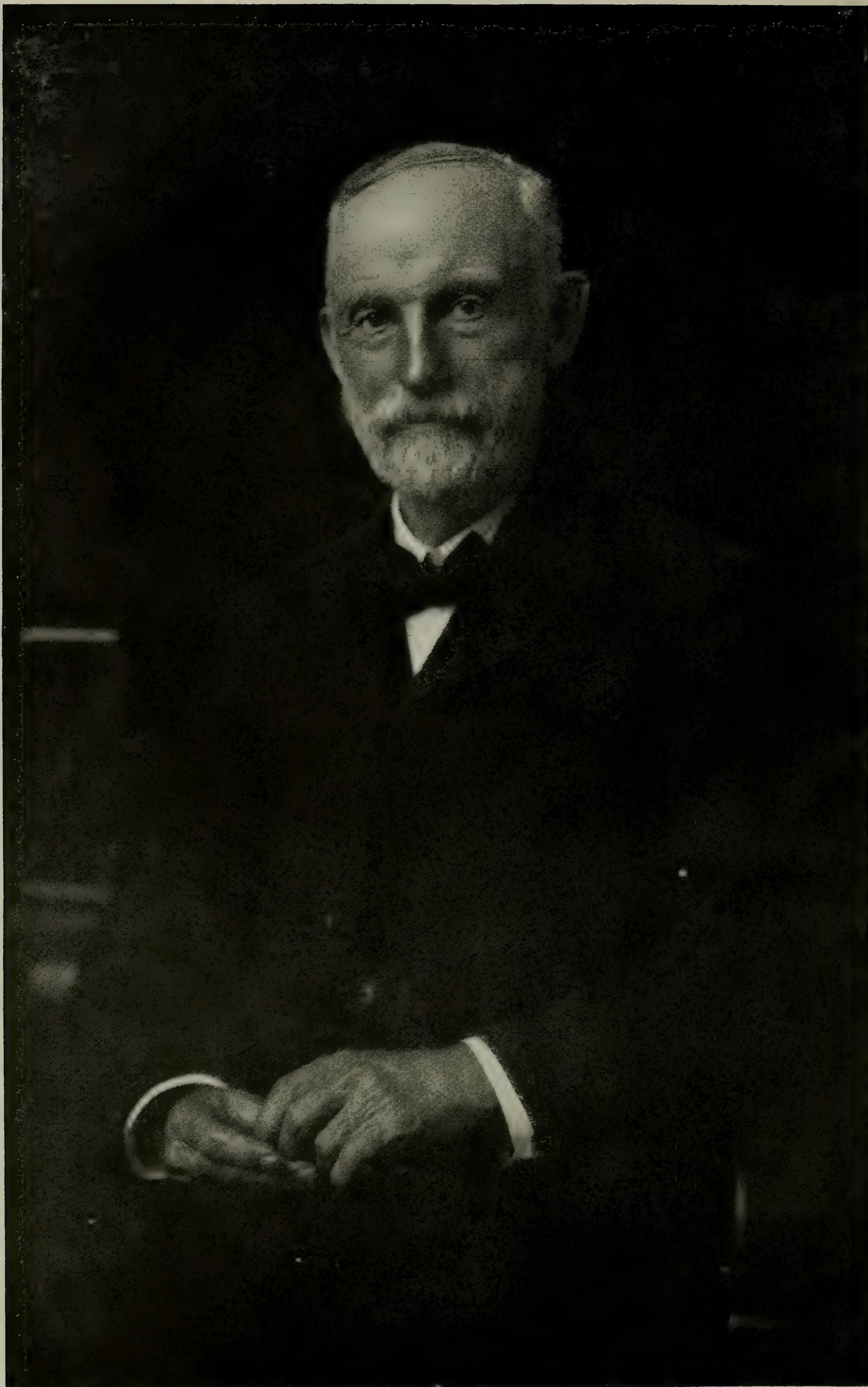
But there is an ethical as well as a commercial side to bee culture that should be mentioned. Thousands of people all over the world have found health and happiness in the keeping of bees; for, be it noted, they may be kept in any back yard in any climate, and yield not only a large amount of pleasure but profit as well. Many thousands more make bee-keeping a side issue in connection with some other business or profession, and who, by such work as this, are enabled to increase their already modest income, thus making a comfortable living.

In addition to all this, the study of bees opens up a new world and a new science. The professional and business man finds that he can give his fagged brain a rest and a respite from the cares of the day. It is no great wonder, then, that the A B C of 1877, of 200

pages in the early days, should now be the A B C and X Y Z of Bee Culture of 750 pages. This edition now reaches the number of 146,000 copies.

If there was ever a rural pursuit that made greater progress in half a century in this country than bee culture the writer does not know it; and yet many are so optimistic that they believe the industry is only in its infancy.

May 1, 1913.



A. I. Root

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[*Note.*—Strangely enough, some of our A B C scholars have attempted to take up each subject in this work in its consecutive order. As this is a cyclopedia on bee culture it should no more be read in this manner than a dictionary or cyclopedia. As a guide to the beginner we would suggest that he take for his course of reading the subjects in the following order: BEGINNING WITH BEES; APIARY; PROFITS IN BEES; HIVES; FRAMES, HOW TO MANIPULATE; ANGER OF BEES; STINGS; ROBBING; BEE BEHAVIOR; NUCLEUS; FEEDING; SWARMING; ARTIFICIAL SWARMING; ABSCONDING SWARMS; COMB HONEY; EXTRACTED HONEY; QUEENS; QUEEN-REARING; UNITING; TRANSFERRING; SPRING MANAGEMENT; WINTERING. Other subjects may be taken up as deemed best, for then the learner will be able to read any thing in the book understandingly.]

ABSCONDING SWARMS.—No part of animated creation exhibits a greater love of home than does the honey-bee. No matter how humble or uninviting the surroundings bees seem very much attached to their home; and as they parade in front of their doorway after a hard day's work, plainly indicate that they have a keen idea of the rights of ownership and exhibit a willingness to give their lives freely, if need be, in defense of their hard-earned stores. It is difficult to understand how they can ever be willing to abandon it altogether, and with such sudden impulse and common consent. No matter if they have never seen or heard of such a thing as a hollow tree, but have for innumerable bee generations been domesticated in hives made by human hands, none the less have they that instinctive longing that prompts them to seek the forest as soon as they get loose from the chains of domestication. It is probable that the bees as they go out foraging keep an eye out for desirable places for starting new homes. Indeed, we positively know that they generally have the hollow trees picked out some time before deciding to leave. Many incidents have been reported that prove this beyond any question.

We once found our bees working strongly on a particular locality about a mile and a half from the apiary, where the white clover was blooming with most unusual luxuriance. Very soon after, a colony swarmed, and the bees, after pouring out of the hive, took a direct line for a tree in this clover-field, without so much as making any attempt to cluster at all. Did they not figure out the advantage of having only a few rods instead of over a mile to carry their honey, after having patiently gathered it from the blossoms, little by little?

Perhaps it will be well to remark here, that it is very unusual for a swarm to go to the woods without clustering; the bees usually hang from 15 minutes to an hour, and many times several hours; in fact, we have known them to hang over night, and sometimes stay and build comb; but perhaps it would be well to take care of them inside of 15 or 20 minutes if we would make sure of them. Long before swarming-time, hives should all be in readiness, and they should also be located near where the new colony is to stand. If one is going to have a model apiary, he should not think of waiting until the bees swarm before he lays it out, but take time by the forelock, and with careful deliberation decide where every hive shall be before it is peopled with bees, if he would keep ahead and prevent his bees from taking "French leave."

But they sometimes leave, even after they have been carefully hived in modern hives on frames of foundation. If the swarming mania gets under way in a bee-yard, a swarm is more apt to come out the second time, even when hived in a new location in a different hive, than where there is only a very little swarming. It was once thought that giving a frame of unsealed brood to these second-time absconders would hold them. While this, no doubt, acts as a restrainer, yet when a swarm leaves its new quarters we would recapture it, hive it back into the hive, and then carry hive, bees, and all down cellar and keep them there several days until they get over their mania. They may then be set out on their permanent summer stands.

How are we to avoid losing the occasional swarm that goes off without clustering at all? or the quite frequent cases of coming out unobserved, or when no one is

at home? There is a very certain and safe remedy for all cases of first swarming, in having the wings of the queen clipped, or using an Alley trap, so she can not fly. Wing clipping is in very general use, and answers excellently for all first swarms; but, alas! the after swarms are the very ones that are most apt to abscond, and we can not clip the wings of *their* queens, because they have not yet taken their wedding flight. What shall we do? In the first place, second or after swarms should *not be allowed.* If the parent hive, after it has cast its first swarm, is treated as recommended under the head of AFTER SWARMING, there will be no further swarming from that colony for that season. We recommend the Heddon method, given at the close of AFTER SWARMING.

Clipping the wings of the queen or putting on drone traps (see DRONES) will prevent losing first swarms by absconding, it is true; but it does not always prevent losing the queen. She goes out with the bees as usual, and, after hopping about in front of the hive, sometimes gets ready to go back at about the same time that the bees do, after having discovered she is not in the crowd. Even if she gets some little distance from the hive, the loud hum they make as they return will guide her home many times; but unless the apiarist is at hand at such times to look after affairs, many queens will be lost, and the bees will rear a lot of young queens and go into after swarming in good earnest, making even the first swarm an "after swarm." A German friend, who knows little of bee culture, once told us our bees were swarming, and if we did not ring the bells, etc., they would certainly go to the woods. As we quietly picked up the queen in passing the hive, we told him if they started to go away we would call them back. Sure enough they did start for the woods, and had gone so far that we really began to be frightened ourselves, when, away in the distance, we saw them suddenly wheel about, and then return to the hive at our very feet. While he gave us the credit of having some supernatural power over bees, we felt extremely glad we had taken precautions to clip all our queens' wings but a few days before. After this we felt a little proud of our control over these wayward insects, until a fine swarm of Italians started off under similar circumstances, and despite our very complacent, positive remarks, to the effect that they would soon come home, they went off and stayed "off." In a humbler, and, we dare say, wiser frame of mind, we investigated, and found they had joined with a very small third swarm of black bees that had just come from one of the neighbor's hives. We tried to "explain," but it required a five-dollar bill to make matters so clear that we could carry back our rousing swarm of yellow bees, and sort out the black unfertile queen, that they might be made to accept their own.

ABSCONDING FOR WANT OF FOOD.

Perhaps bees oftener desert their hives because they are short of stores than from any other cause; and many times, in the spring, they seemed to desert because they were nearly out. They issue from the hive, and alight in a tree very much like a normal swarm during the swarming season. The remedy, or, rather, preventive, for this state of affairs, is so plain we hardly need discuss it. After they have swarmed out, and are put back into the hive, give a heavy comb of sealed stores; if that can not be obtained, feed them a little at a time, until they have plenty, and be sure that they have brood in the combs. If necessary, give them a comb of unsealed larvæ from some other hive, and then feed them until they have a great abundance of food. One should be ashamed of having bees abscond for want of food.

ABSCONDING NUCLEUS SWARMS.

A very small nucleus—if it contains no more than a couple of hundred bees—is liable to swarm out. Queen-breeders, in attempting to mate queens in baby nuclei containing only one or two section boxes, had considerable trouble in keeping the bees in the hive, especially when the young queen went out to mate. Accordingly it was found necessary to make the baby hives much larger, with frames 5⅝x8 inches, and two nuclei to a hive. See QUEEN REARING.

With these there is not much trouble from swarming out, providing that they are well supplied with bees, some brood, and honey.

ABSCONDING FOR MORE SATISFACTORY QUARTERS.

There is still another kind of absconding that seems to be for no other reason than

that the bees are displeased with their hive, or its surroundings, and, at times, it seems rather difficult to assign any good reason for their having suddenly deserted. We have known a colony to swarm out and desert their hive because it was too cold and open, and we have known them to desert because the combs were soiled and filthy from dysentery in the spring. They very *often* swarm out because they are out of stores, and this generally happens about the first day in spring that is sufficiently warm and sunny. We have known them to swarm out because their entrance was too large, and, if we are not mistaken, because it was too small.

We have also known them to swarm out because they were so "pestered" with a neighboring ant-hill—see ANTS—that they evidently thought patience ceased to be a virtue.

ABSCONDING IN THE SPRING.

They often swarm out in the spring where no other cause can be assigned than that they are weak and discouraged, and in such cases they usually try to make their way into other colonies. While it may not always be possible to assign a reason for such behavior with medium or fair colonies, we may rest assured that good strong colonies, with ample supplies of sealed stores, seldom, if ever, go into any such foolishness.

It seems to occur just at a time when we can ill afford to lose a single bee; and, worse still, only when our stocks are, generally, rather weak, so that we dislike the idea of losing any of them. In this case they do not, as a general thing, seem to care particularly for going to the woods, but rather take a fancy to pushing their way into some of the adjoining hives, and, at times, a whole apiary will seem so crazy with the idea as to become utterly demoralized.

A neighbor, who made a hobby of small hives—less than half the usual size—one fine April day had as many as 40 colonies leave their hives and cluster together in all sorts of promiscuous combinations. To say that their owner was perplexed, would be stating the matter very mildly.

Similar cases, though perhaps not as bad, have been reported from time to time, ever since novices commenced to learn the science of bee culture; and although cases of swarming out in the spring were known once in a great while before the recent improvements, they are nothing like the mania that has seemed to possess entire apiaries—small ones—since the time of artificial swarming, honey extractors, etc. We would by no means discourage these improvements, but only warn beginners against making too much haste to be rich. We would not commence dividing our bees until they are abundantly strong. They should go into winter quarters with an abundance of sealed honey in tough old combs as far as may be; and should have hives with walls thick and warm, of some porous material, such as chaff or straw, with a good thickness of the same above, then we shall have little cause to fear any trouble from bees absconding in the spring.

SUMMARY.

By way of summing up, it may be well to say: If you would not lose your bees by natural swarming, clip the wings of all queens as soon as they commence laying; then look to them often, but not necessarily *into* them, and know what is going on in the apiary every day during the swarming season. If you would not have runaway swarms in the spring, and while queens are being fertilized, confine your experiments to pecks of bees instead of pints.

ACTIVITIES OF BEES.—See BEE BEHAVIOR.

ADULTERATION OF HONEY.—Until the passage of the national pure-food bill by Congress, June 30, 1906, liquid or extracted honey was quite often adulterated, it being safe to buy only comb honey; but with the passage of the bill, and the careful work of the Department of Agriculture inspectors, besides the work of the individual State food commissions, this has been brought to a minimum. The label on the bottle must tell the composition of the contents. Honey can bear that label only when it is pure, but if mixed with other substances these must appear on the label in as large type as the honey.

The most common forms of adulteration which are practiced at present in the sophistication of honey are the addition of commercial glucose, cane sugar, and invert sugar. The adulteration of honey by dilution

with water is less commonly practiced; such addition is easily recognized by the increased fluidity of the honey, and there is, besides, the increased danger that the product will spoil through fermentation.

Since the food standard requires the product to contain less than 25 per cent water, the beekeeper can determinne the water content of his product by accurately weighing a gallon of his product. The net weight should be over 11½ pounds, or, by means of a Beaume hydrometer ranging from 0 to 50 degrees, which can be obtained from any chemical house, and a glass cylinder 12 inches high and 1½ inches in diameter, he can ascertain the weight of his product. By filling the cylinder with the honey, allowing the air bubbles to come to the top, and cooling to 70 degrees Fahr., the hydrometer is allowed to float in the liquid. It should float at the mark of 42 degrees for a product of less than 25 per cent water.

Commercial glucose is not used so much now as formerly. Its presence is easily detected by the chemist. For a description of this product see GLUCOSE.

The addition of cane-sugar syrup is also easily detected by the experienced chemist. The standard allows 8 per cent sucrose to be present, which is far in excess of what is ordinarily found in pure honey; and, while this may seem an arbitrary amount, it is certainly to the honey producer's advantage to have a standard provided. Any excess of 8 per cent would surely be called an adulteration.

The adulteration of honey with invert sugar syrup is being practiced to some extent in this country, though not so widely at present as in certain parts of Europe. This syrup has in many respects the same compositon as pure honey; it is deficient, however, in ash, albuminoids, and other constituents which occur in honey in small amounts. It is recognized by the expert chemist on account of some of its ash constituents and other chemical constituents, while not with the ease that the presence of glucose is told, but with sufficient accuracy to determine its presence in mixture.

AFTER SWARMING.—We might define this by saying that all swarms that come out, or are led out by a VIRGIN QUEEN, are termed after swarms; and all swarms after the first swarm are accompanied by such queens. There may be from one all the way up to a half dozen or even more, depending on the yield of honey, amount of brood or larvæ, and the weather; but whatever the number, they are all led off by queens reared from one lot of queen cells, and the number of bees accompanying them is, of necessity, less each time. The last ones frequently contain no more than a pint of bees, and, if hived in the old way, would be of little use under almost any circumstances; yet when supplied with combs already built and filled with honey, such as every enlightened apiarist should always keep in store, they may be made the very best of colonies, for they have young and vigorous queens, and often are equal to any in the apiary the next season.

It has been said that when a colony has decided to send out no more swarms, all the young queens in the hive are sent out, or, it may be, allowed to go out with the last one. Whether this is true or not, we can not say; but every few days during the swarming season, some "new hand" writes us about the wonderful fact of his having found three or four, or it may be a half dozen queens in one swarm. On one occasion, a friend, who weighed something over 200, ascended to the top of an apple tree during a hot July day to hive a small third swarm. He soon came down, in breathless haste, to inform us that the swarm was *all queens;* and, in proof of it, brought two or three in his closed-up hands.

Years ago after swarming was considered a sort of necessary evil that had to be tolerated because it could not be obviated; but in no well-regulated apiary should it be allowed. Many consider it good practice to permit one swarm—the first one. After that all others are restrained. Cutting out all the queen cells but one may have the effect of preventing a second swarm; but the practice is objectionable—chiefly because one *can not be sure* that he destroys all but one. If there are two cells the occupant of one of them, when she hatches, is likely to bring out an after swarm; indeed, we may say that, as long as there are young queens to hatch, there are likely to be after swarms up to the number of three or four.

But many practical honey producers consider cell cutting for the prevention of

these little swarms as waste of time, although they may and do cut out cells to prevent prime or first swarms. There are some who deem it advisable to prevent swarming. The plan usually adopted to prevent second swarms is about as follows:

The wings of all queens in the apiary should be clipped, or else there should be entrance guards over the colonies. As soon as the first swarm comes forth, and while the bees are in the air, the queen, if clipped, is found in front of the entrance of the old hive. She is caged, and the old hive is lifted off the old stand, and an empty one containing frames of foundation or empty combs is put in its place. A perforated zinc honey board is then put on top, after which, the supers, now on the old stand. The queen in her cage is placed in front of the entrance, and the old hive is next carried to an entirely new location. In the mean time the swarm returns to find the queen at the old stand; and when the bees are well started to running into the entrance she is released, and allowed to go in with them. Most of the old or flying bees that happen to be left in the old colony, now on the new location, will go back to the old stand to strengthen further the swarm. This will so depopulate the parent colony that there will hardly be bees enough left to cause any after swarming, and the surplus of young queens will have to fight it out among themselves—the "survival of the fittest" being, of course, the only one left. She will be mated in the regular way, and the few bees with her will not, of course, follow her. In a short time comparatively the old parent colony will be strong enough for winter.

HEDDON'S METHOD.

The first swarm is allowed to come forth; and while it is in the air the parent colony is removed from its stand and placed a few inches to one side, with its entrance pointing at right angles to its former position. For instance, if the old hive faced the east, it will now look toward the north. Another hive is placed on the old stand, filled with frames of wired foundation. The swarm is put in this hive, and at the end of two days the parent hive is turned around so that its entrance points in the same direction as the hive that now has the swarm. Just as soon as young queens of the parent colony are likely to hatch it is carried to a new location during the middle of the day or when the bees are flying the thickest. The result is, these flying bees will go back to the hive having the swarm. This, like the other method described, so depletes the parent hive that any attempt at after swarming is effectually forestalled.

A variation from this plan makes it easier and just as good. Hive the swarm on the old stand and set the old hive close beside it, both facing the same way. A week later, when most bees are out, remove the old hive to a new stand. That leaves the old colony just as much depleted as the longer way; and the depletion coming more suddenly will more thoroughly discourage all thought of further swarming.

AGE OF BEES.—It may be rather difficult to decide how long a worker bee would live if kept from wearing itself out by the active labors of the field; six months certainly, and perhaps a year; but the average life during the summer time is not over three months, and perhaps during the height of the clover bloom not over six or eight weeks. The matter is easily determined by introducing an Italian queen to a hive of black bees at different periods of the year. If done in May or June, we shall have all Italians in the fall; and if we note when the last black bees hatch out, and the time when no black bees are to be found in the colony, we shall have a pretty accurate idea of the age of the blacks. The Italians will perhaps hold out under the same circumstances a half longer. If we introduce the Italian queen in September, we shall find black bees in the hive until the month of May following—they may disappear a little earlier, or may be found a little later, depending upon the time they commence to rear brood largely. The bees will live considerably longer if no brood is reared, as has been several times demonstrated in the case of strong queenless colonies. It has been said that black bees will live longer in the spring than Italians—probably because the latter are more inclined to push out into the fields when the weather is too cool for them to do so with safety; they seldom do this, however, unless a large amount of brood is on hand, and they are suffering for pollen or water.

During the summer months, the life of the worker bee is probably cut short by the

wearing out of its wings, and we may, at the close of a warm day, find hundreds of these heavily laden, ragged-winged veterans making their way into the hives slowly and painfully, as compared with the nimble and perfect-winged young bees. If we examine the ground around the apiary at nightfall, we may see numbers of these old bees hopping about, evidently recognizing their own inability to be of any further use to the community. We have repeatedly picked them up and placed them in the entrance, but they usually seem only bent on crawling and hopping off out of the way where they can die without hindering the teeming rising generation. During the height of a honey-flow workers probably do not live more than six weeks.

AGE OF DRONES.

It is somewhat difficult to decide upon the age of drones, because the poor fellows are so often hustled out of the way, for the simple reason that they are no longer wanted; but we may be safe in assuming it is something less than the age of a worker. If kept constantly in a queenless hive they might live for three or four months. Occasionally some live over winter, say from September to April.

AGE OF THE QUEEN.

As the queen does little or no outdoor work, and is seldom killed by violence as are the drones, we might expect her to live to a good old age, and this she does, despite her arduous egg-laying duties. Some queens die, seemingly, of old age, the second season, but generally they live through the second or third, and we have had them lay very well even during the fourth year. They are seldom profitable after the third year, and the Italians will sometimes have a young queen "helping her mother" before she becomes unprofitable.

If a large amount of brood is found in a hive, two queens will often be found, busily employed, and this point should be remembered when introducing queens.

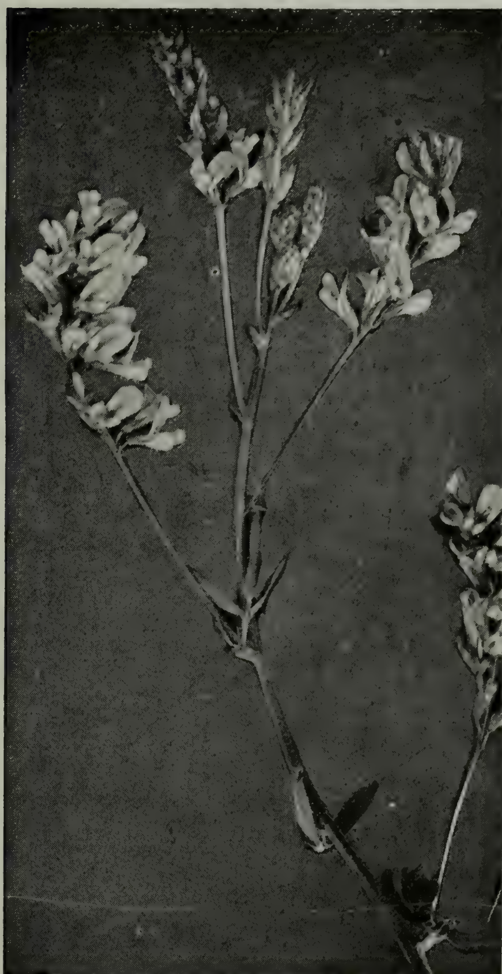
ALFALFA (*Medicago sativa* L.).—This is known also as lucerne, purple medick, Spanish trefoil, Brazilian clover, and snail clover. Introduced from Europe, and widely cultivated for hay and green fodder, but grows spontaneously in fields and waste places from Massachusetts to Minnesota, and southward as far as Virginia. Alfalfa belongs to the pea family (*Papilionaceae*), and greatly resembles sweet clover (*Melilotus alba*), which is described in this work under head of SWEET CLOVER. Alfalfa has now come to be one of the most important honey plants of the great West—especially in those arid regions that have to be irrigated. It is grown most extensively in Colorado, Wyoming, Arizona, Nevada, Utah, Kansas, Nebraska, New Mexico, Washington, Oregon, Idaho, and is now making very rapid strides in California, Texas, and other States. In California, irrigated alfalfa is regarded as more reliable than any other honey plant, and in dry seasons exceeds the sage in importance.

It has been grown, in an experimental way, in many of the Eastern States; but outside of irrigated regions, and some parts of the West not irrigated, it is not known to yield honey to any considerable extent. Mr. S. D. House of Camillus, N. Y., however, reports getting a considerable amount of honey from it. While alfalfa makes an excellent forage plant for stock in a few localities in the East, permitting from two to four cuttings, it is grown as a hay particularly in the western States mentioned; for there is no other forage plant that will yield the same value per acre of fodder or hay in the regions that have to be irrigated. It yields anywhere from three to five tons per acre, and gives from three to five cuttings to the season, and, under favorable circumstances, it is even claimed that six and seven have been made. For the best hay it should be cut when the blooming commences; but, unfortunately for the beekeeper, this also cuts off the supply of nectar when it is flowing at its very best; for alfalfa, when in bloom in the irrigated regions, is perhaps the greatest honey plant in the world. But notwithstanding the interests of the beekeeper, the ranchers cut their alfalfa just as soon as it begins to bloom, irrespective of the fact that it is "killing the goose that lays the golden egg" for the bee-keeper. After cutting, it is stacked in the open field* in a stack that will run from 10 to 100 tons in capacity.

As one goes through the irrigated regions of Arizona, California, Idaho, Utah, and

*In the irrigated regions it scarcely ever rains, and therefore great barns for the storage of the hay are not necessary.

Colorado, in a Pullman car going at the rate of 50 or 60 miles an hour, he sees hundreds and hundreds of such stacks; and where one stack has been cut into, or opened up, he sees not the dull grayish brown hay of the East, but a beautiful grass-green clover hay; and it seems to keep green no matter how old it is, provided it is not faded out by the intense sunlight that pours down with such relentless fury on the Great



Alfalfa blossom.

American desert. But it is only the top layers that are faded. A few inches below, the hay is of the beautiful green color.

The irrigation needed to grow it for forage makes the crop almost certain; and those beekeepers located in the vicinity of alfalfa growing can rely almost as certainly on a crop of honey, the very finest, richest, thickest in the world. Of all the honey we have ever tasted we know of nothing, not even clover (which has formerly held the first rank), that can equal it. It runs from 12 to 13 pounds to the gallon, while most eastern honeys run from 11 to 12 pounds. This heaviness of body is due to the dryness of the atmosphere in which it grows; for where alfalfa flourishes at its best, hives made of the best seasoned white pine will shrink and twist and check in a manner that is truly astonishing to a "tenderfoot." A light dry atmosphere a mile above the level of the sea, in the regions of Denver, almost entirely devoid of dews and frosts, a cloudless sky, occasional hot winds, a bright sun that pours down, unobstructed by cloud or mist, causes every thing to dry up, and even honey to thicken—so much so that it is difficult to throw it out of combs with the best extractors. Indeed, we found that some beekeepers were obliged to place their extractors in warm rooms, and even warm the combs sometimes before extracting, so thick is the honey. And then to do any thing like a good job of extracting one must give the extractor baskets a high rotative speed, and this necessarily puts a great strain on the wire cloth and the bracing of the extractor.

We have already spoken of the superb quality of alfalfa honey. If any one takes a liking to it, as we have done, he will be almost spoiled for eating any other honey. Some of it is so thick and fine that it can be almost chewed like so much delicious wax candy. The flavor is a little like that of white clover, with a slight trace of mint that is very pleasant. In color it is quite equal to it, and in every other way it has no superior, although in some parts of the West the color is a light amber. In the very hot portions of the United States it is disposed to be darker than in the cooler localities. The Colorado alfalfa is as a rule the lightest in color.

The nectar from alfalfa is secreted so abundantly during the time it is in bloom that anywhere from 100 to 500 colonies can be supported in a given location. In Colorado, however, it is found more profitable to have apiaries containing no more than from 100 to 150 colonies, owing to the very great overstocking in many of the best localities. Beekeepers have rushed to this land of gold and golden honey in such numbers that in the great alfalfa-growing re-

THE CELEBRATED ALFALFA PLANT AND ROOT.

The plant represented in this plate grew in a rich, loose soil, with a heavy clay subsoil and an abundant supply of water, the water level ranging from 4 to 8 feet from the surface at different seasons of the year. The diameter of the top was 18 inches, and the number of stems 360. The plate shows how these crowns gather soil around them, for the length of the underground stems is seen to be several inches, and this represents the accumulation of nearly this much material about it.

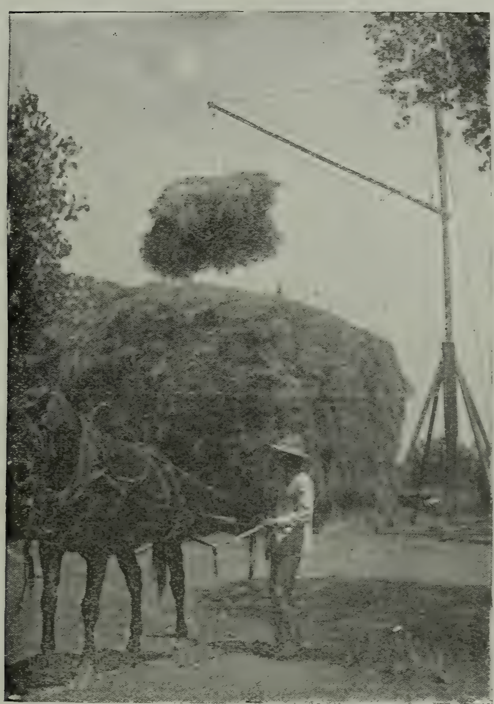
This is one of the largest plants that I have yet found. The specimen, as photographed, was dug April 30, 1896.—*Dr. Headden, in Bulletin No. 35, "Alfalfa."*

gions apiaries are stuck in very closely, from half a mile to a mile apart, so it is not now profitable to have more than 100 colonies to the yard. In other localities not so much overstocked, from 200 to 300 colonies can be kept in a single apiary.

For a given acreage there is no plant or tree, unless it is basswood, tupelo, or log-

wood, that will support as many colonies. In several localities in Colorado and Arizona, within a radius of five miles there will be anywhere from two to seven thousand colonies, the like of which can not be found anywhere else in the world, probably.

In Kansas and Nebraska, in the unirrigated regions, it is being grown more and more; where, too, it is so dry, and the soil so alkaline, it was supposed nothing would grow. It has been found that the roots of the alfalfa will pierce the hardpan, reach down into the moist subsoil, and leach out the alkali. Some of these lands have thus



Method of stacking alfalfa hay.

been transformed into productive ranches. With the onward march of the alfalfa has come the busy bee to take its share of the wealth.

There is scarcely a prettier sight than alfalfa when in bloom. The beautiful bluish or violet tinted flowers present a mass of color that is truly striking to one who has never seen the like of it before; and the fields are measured, not by the acre, but by the square mile. Indeed, we rode through one ranch in a Pullman car, going probably 50 miles an hour, that seemed all of 40 minutes in going through it—not acres, but miles and miles of it as far as the eye could reach on each side of the track; and stacks and stacks of it, aggregating 100 tons to the pile, more than one could count if he were to try. Imagine, if you please, the effect of seeing such a field all in bloom, and mowing machines going through it cutting it down. Imagine, too, the happy hum of the bee going to and from these immense fields. Then, truly, is the harvest of both rancher and beekeeper.

No time is lost. The rancher is eager to get the whole cut as *soon as possible.* The beekeeper, on the other hand, hopes that his rancher co-laborer may make as *slow* work as possible; for, as the mowing machines go through the field, the beekeeper sees a gradual decrease in the flow of nectar. At the rate the mowers are progressing he can tell to a day when the hay will all be cut, and when the honey or the nectar will cease to flow. In producing comb honey he supplies his colony with just enough sections so the bees may fill every one of them at the close of the honey flow which he knows in advance to a day. When the hay is all cut, then he awaits the new growth, the new bloom, and then, again, there is a scramble for honey on the part of the beekeeper and the bees, and another scramble to get the hay down before it grows to be too old or out of bloom.

There is a growing tendency of late for the ranchman in some localities to cut the hay *before* it comes into bloom. It is claimed that the early cutting makes a better quality of hay. However that may be, if the practice should become universal one of the greatest honey plants of the world will be cut off from the bees. In any case, fortunate is that beekeeper who is located in the vicinity of those alfalfa fields devoted to the growing of alfalfa *seed;* for all such have the benefit of the entire blooming until the flower fades and the seed pod takes its place. It is in these regions especially that a large number of colonies per yard can be supported.

Most of the best alfalfa fields in the West have been taken by beekeepers; and unless one can take a range vacated by another by death or otherwise, or get it by purchase, it is a matter of common honor that the new comer should keep out; still there are some who will squeeze in just a few colonies and gradually encroach upon the territory until there is not much in it for any one.

The way alfalfa hay is stacked on 1000 and 5000 acre farms in the west.

APPEARANCE OF THE ALFALFA.

To one who is unacquainted with the plant, alfalfa looks a good deal like sweet clover; and when the two plants are young it takes even an expert to detect the difference; but as they grow older the alfalfa assumes more of a heavy bushy character; and the other, sweet clover, takes on more the appearance of a tree-like weed.

CULTIVATION OF ALFALFA.

While it seems to grow best in the arid regions watered by the irrigation ditches, it also grows in localities where there is not too much rainfall or the soil is not too wet. It seems to do best on a light sandy soil with a loose or porous subsoil, and the roots run for 4 to 12 feet down—on the average perhaps 5 or 6 feet. The seed may be sown broadcast or in drills about 12 inches apart. The amount per acre varies greatly. Some think that 10 pounds is sufficient, while others argue in favor of 30 pounds. The average amount seems to be from 15 to 20 pounds. If too small an amount of seed is sown, the plants grow large and coarse; whereas if a larger amount is used, a larger number of plants result in smaller stems and better hay.

Alfalfa is what is called a perennial—that is, it lives from year to year, and the great difficulty of growing it in the East is to get it to make a stand. If it can be once started it will grow on from year to year with very little trouble.

The average life of the plants under ordinary conditions seems to be about twelve years, although some claim they will live as long as fifty years; but good authorities seem to doubt the statement.

Of late years the culture of alfalfa has been taken up in the Central, Southern, and Eastern States to a considerable extent, and with some success. It ought to be understood, however, that it is most useful where "soiling" is practiced. European farmers who live in a similar climate prefer sainfoin to alfalfa, claiming it produces a finer hay, and is otherwise more suitable. For Southern Europe soola is preferred. All three are similar in habit and culture, but alfalfa is the rankest grower. See Sainfoin.

For some of the data just given, and for the halftone illustration shown on page 8, we are indebted to Bulletin No. 35, entitled "Alfalfa," from the State Agricultural College, Fort Collins, Col., by Dr. W. P. Headden, Chemist.

ALSIKE CLOVER.—See Clover.

ANATOMY OF THE BEE.—The three parts of the body of the bee are well separated by constrictions. The head carries the eyes, antennæ, and mouth parts; the thorax, the wings and legs; and the abdomen, the wax glands and sting.

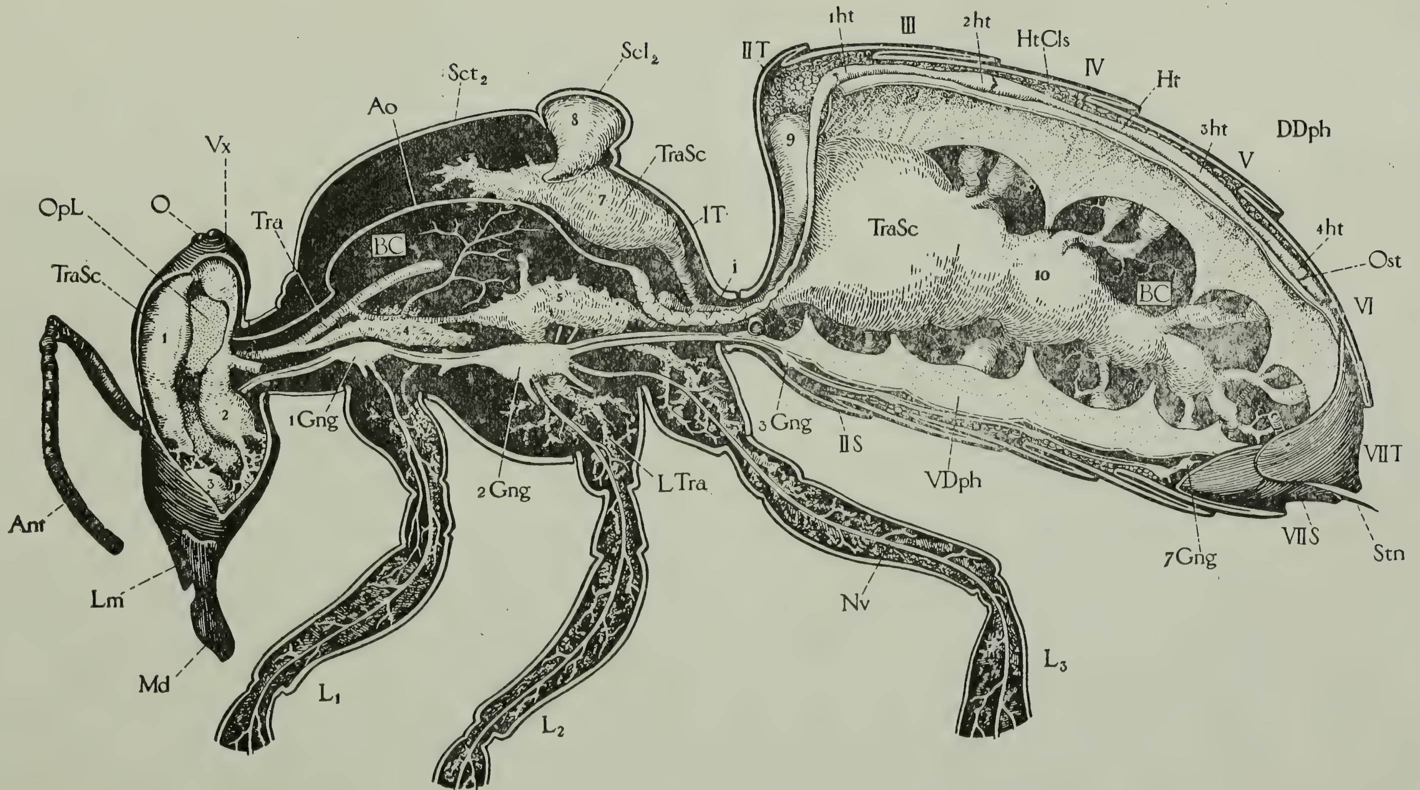
The *head* is flattened and triangular, being widest crosswise through the upper corners, which are capped by the large compound eyes. It carries the *antennae,* or feelers, on the middle of the face (Fig. 2, A, *Ant*); the large *compound eyes* (*E*) laterally; three small simple eyes or *ocelli* (*O*), at the top of the face, and the *mouth parts* (*Md, Mx,* and *Lb*) ventrally. Each antenna consists of a long basal joint and of a series of small ones hanging downward from the end of the first. The antennæ are very sensitive to touch, and contain the organs of smell. At the lower edge of the face is a loose flap (Fig. 2, A, *Lm*) forming an upper lip called the *labrum.* On its under surface is a small soft lobe called the *epipharnyx* on which are located the organs of taste. At the sides of the labrum are the two heavy jaws, or *mandibles* (*Md*), which work sidewise. They are spoon-shaped at their ends in the worker, but sharp pointed and toothed in the queen and drone. Those of the queen are largest, those of the drone smallest. Behind the labrum and mandibles is a bunch of long appendages, usually folded back beneath the head, which together constitute the *proboscis* (Fig. 2, A, *Prb*). These organs correspond with the second pair of jaws, or *maxillae,* and the lower lip, or *labium,* of other insects. In Fig. 2 they are cut off a short distance from their bases, but are shown detached from the head and flattened out in Fig. 3, D. The middle series of pieces (*Smt-Lbl*) constitutes the labium, the two lateral series (*Cd-Mx*) the maxillæ. The labium consists of a basal *submentum* (*Smt*), and a *mentum* (*Mt*), which supports distally the slender, flexible, tongue like *glossa* (*Gls*), the two delicate *paraglossae* (*Pgl*), and the two lateral, jointed labial palpi (*Lb Plp*). Each maxilla is composed of a basal stalk, the *cardo* (*Cd*); a main plate, the *stipes* (*St*), and a wide terminal blade (*Mx*) called the *galea.* At the base of the galea is a rudimentary *maxillary palpus* (*MxPlp*), representing a part which in most insects consists of several slender joints.

As before stated, the parts of the maxillæ and the labium together constitute the proboscis, which, as shown in Fig. 2, B, is suspended from a deep cavity (*PrbFs*) on the lower part of the back of the head having a membranous floor. The nasal stalks (*Cd*) of the maxillæ are hinged to knobs on the sides of this cavity, while the labium is attached to the maxillary stalks by means of a flexible band called the *lorum* (Fig. 3, D, *Lr*).

When the bee wishes to suck up any liquid, especially a thick liquid like honey or syrup, provided in considerable quantity, the terminal lobes of the labium and maxillæ are pressed close together so as to make a tube between them. The labium is then moved back and forth between the maxillæ with a pump-like motion produced by muscles within the head. This brings the liquid up to the mouth, which is situated above the base of the proboscis, between the mandibles and beneath the labrum. The food is then taken into the mouth by a sucking action of the pharynx, produced by its muscles.

A more delicate apparatus is probably necessary, however, for sucking up minute drops of nectar from the bottom of a flower. Such a structure is provided within the glossa. This organ (Fig. 3, D, *Gls*), ordinarily called the "tongue," is terminated by a delicate, sensitive, spoonlike lobe known as the labella (Fig. 3, A, B, and D, *Lbl*), and has a groove (*k*) running along its entire length on the ventral side. Within the glossa this groove expands into a double-barreled tube (Fig. 3, E, *Lum*). A flexible chitinous rod (*r*) lies along the dorsal wall of this channel, which is itself provided with a still finer groove (*l*) along its ventral surface. Thus the very smallest quantity of nectar may find a channel suited to its bulk through which it may run up to the base of the glossa by capillary attraction. But since the glossal channels are ventral the nectar must be transferred to the dorsal side of the labium by means of the paraglossæ, the two soft lobes (Fig. 3, D and F, *Pgl*) whose bases are on the upper side of the mentum, but whose distal ends underlap the base of the glossa, and thus afford conduits for the nectar around the latter to the upper side of the labium. The glossa is highly extensible and retractile by means of muscles attached to the base of its rod, and its movements when a bee is feeding are very conspicuous, and interesting to watch.

The *thorax* of an insect carries the wings and the legs. The two wings of the bee on each side are united to each other by a



From Bulletin No. 18, "The Anatomy of the Honeybee," by Snodgrass, Dept. of Ag., Washington, D. C.

FIG. 1.—Longitudinal, median, vertical section of worker, exposing body cavity (*BC*) in right side, with alimentary canal (Fig. 6) removed, but showing tracheal system (*Tra*, *LTra*, and *Tra Ss 1-10*), heart (*Ht*), and aorta (*Ao*); dorsal diaphragm (*DDph*), ventral diaphragm (*VDph*, and nervous system (*OpL*, *1Gng-7Gng*). *Ao*, aorta; *Ant*, antenna; *BC*, body cavity; *DDph*, dorsal diaphragm; *Gng*, ganglion; *1Gng*, *2Gng*, first and second thoracic ganglia; *3Gng-7Gng*, abdominal ganglia; *Ht*, heart; *1ht-4ht*, chambers of heart; *i*, convolutions of aorta; *L*, leg; *L1*, *L2*, *L3*, prothoracic, mesothoracic, and metathoracic legs; *Lm*, labrum, *LTra*, trachea of leg; *Md*, Mandible; *Nv*, nerve (of leg); *O*, ocelli; *OpL*, optic lobe of brain; *Ost*, ostium (aperture of heart); *S*, sternum; *IIS-VIIS*, second to seventh abdominalsterna; *Scl2*, scutellum of mesothorax; *Sct2*, scutum of mesothorax; *Stn*, sting; *Tra*, trachea; *TraSc* (*1-10*), tracheal air-sacs; *T*, tergum; *IT*, propodeum, or first abdominal tergum; *VIIT*, seventh abdominal tergum; *VDph*, ventral tergum; *Vx*, vertex.

series of minute hooks so that they work together, and the four wings are thus practically converted into two. Each wing is hinged at its base to the back, and pivoted from below upon a small knob of the side wall of the thorax. The up-and-down motion of the wings is produced, not by muscles attached to their bases, but by two sets of enormous muscles, one vertical and the other horizontal, attached to the walls of the thorax, whose contractions elevate and depress the back plates of the thorax. Since the fulcrum of each wing is outside of its attachment to the back, the depression of the latter elevates the wings, and an elevation of the back lowers the wing. But the bee flies by a propeller-like action, or figure-8 motion of the wings. This is produced by two other sets of much smaller muscles acting directly upon the wing bases, one before and the other behind the fulcrum of each. The combined result of all these muscles is that the down stroke of the wing is accompanied by a forward movement and a deflexion of the anterior edge, while the up stroke reverses this.

The legs of the bee are too familiar to need any extensive description here. Their special characters, such as the antennæ cleaners on the first and the pollen baskets and brushes on the last, are illustrated in Fig. 4. The tarsi are each provided with a pair of terminal *claws* (E, *Cla*), by means of which the bee clings to rough objects, while between the claws is a sticky pad, the *empodium* (*Emp*), which is brought into play when the bee alights on or walks over any smooth surface like glass.

The hind part of the thorax of bees, wasps, and their allies is composed of a segment, which, in other insects, is a part of the abdomen. It is known as the *propodeum*. The middle division of the body of a bee, wasp, or ant, therefore, is not exactly the equivalent of the thorax of a grasshopper, fly, or butterfly.

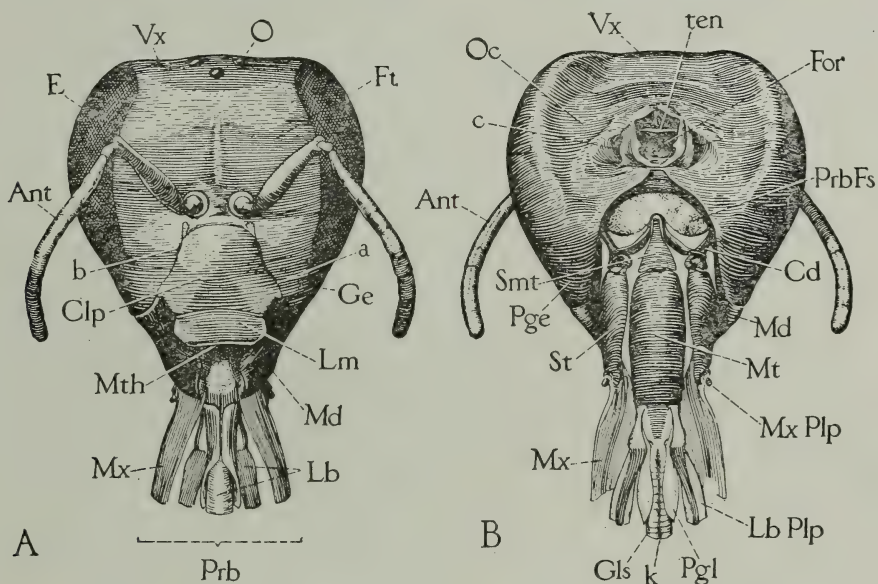


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FIG. 2.—Head of worker with parts of proboscis cut off a short distance from their bases. A, anterior; B, posterior; *a*, clypeal suture; *Ant*, antenna; *b*, pit in clypeal suture marking anterior end of internal bar of head; *c*, pit on occipital surface of head, marking posterior end of internal bar; *Cd*, cardo; *Clp*, Clypeus; *E*, compound eye; *For*, foramen magnum; *Ft*, front; *Ge*, gena; *Gls*, glossa, or "tongue;" *k*, ventral groove of glossa; *Lb*, labium; *LbPlp*, labial palpus; *Lm*, labrum; *Md*, mandible; *Mt*, mentum; *Mth*, mouth; *Mx*, terminal blade of maxilla; *MxPlp*, maxillary palpus; *O*, ocelli; *Oc*, occiput; *Pge*, postgena; *Pgl*, paraglossa; *Prb*, base of proboscis; *PrbFs*, fossa of proboscis; *Smt*, submentum; *St*, stipes; *ten*, small bar of tentorium arching over foramen magnum; *Vx*, vertex.

The abdomen of the bee has no appendages corresponding with those of the head or thorax; but it bears two important organs, viz., the wax glands and the sting. The *wax glands* are simply specially developed cells of the skin on the ventral surfaces of the last four visible abdominal segments of the worker. There are only six segments visible in the apparent abdomen; but remembering that the propodeum of

the thorax is really the first, the wax glands occur, therefore, on segments four to seven inclusive (Fig. 1, IV-VII). The wax secreted by the glands is discharged through minute pores in the ventral plate of each segment, and accumulates in the form of a little scale in the pocket above the underlapping ventral plate of the segment next in front.

The *sting* is such a complicated organ that it is very difficult to describe it clearly in a few words. Fundamentally it consists of three slender, closely appressed pieces forming the sharp piercing organ that projects from the tip of the abdomen (Fig. 1, *Stn*), and of two soft fingerlike lobes, sometimes also visible, all of which arise from three pairs of plates belonging to the eighth and ninth segments of the abdomen, but which are concealed within the seventh segment.

Fig. 5 shows, somewhat diagrammatically, all the parts of the left side. The acute stinging shaft swells basally into a large bulb (*ShB*) which is connected by a basal arm on each side with two lateral plates (*Ob* and *Tri*). The fingerlike lobes, called the *palpi of the sting* (*StnPlp*) are carried also by the lower of these two plates (*Ob*) while the upper (*Tri*) carries the third and largest plate (*Qd*) which partially overlaps the lower (*Ob*).

A close examination of the sting proper shows that both the bulb and the tapering shaft are formed of three pieces. One is dorsal (*ShB* and *ShS*) while the other two (*Lct*) are ventral (of course only one of the latter shows in side view). Furthermore, the basal arm on each side is formed of two pieces, one of which (*ShA*) is continuous with the dorsal piece of the sting, while the other (*Lct*) is continuous with the ventral rod of the same side. Since these ventral rods are partially enclosed within a hollow on the under side of the dorsal piece, the latter is called the *sheath of the sting.* It consists of the terminal *shaft* of the sheath (*ShS*), the *bulb* (*ShB*), and of a *basal arm* (*ShA*) on each side. The ventral pieces (*Lct*) are slender sharp-pointed rods having barbed extremities, and are known as the *lancets.* The shaft of the sheath is grooved along the entire length of its ventral surface, the groove enlarging into a spacious cavity in the bulb. The lancets lie close together against the ventral edges of the sheath, but slide freely upon minute tracks on the latter. The three parts, therefore, inclose between them a cavity which is tubular in the shaft, but enlarged into a wide chamber in the bulb. The great poison sac (Fig. 8, (*PsnSc*) of the acid glands of the sting opens into the base of the bulb along with the smaller, tubular, alkaline gland (*BGl*). By movements of the triangular plates (Fig. 5, *Tri*) the lancets slide back and forth against the sheath while the poison exudes in tiny drops from an opening between them near the tips. The poison sac has no muscles in its walls, and, hence, can not force the poison through the sting. The poison, in fact, is driven out of the latter by a force pump inside of the bulb. This consists of two pouchlike lobes situated on the upper edges of the lancets, having their cavities open posteriorly. When the lancets move forward the walls of these pouches collapse; but when the motion is reversed they flare apart and drive the poison contained in the bulb back through the shaft and out at the end.

The *poison* is an acid liquid formed by the glands (Fig. 8, *AGl, AGl,* and *BGl*). Two of these (*AGl* and *AGl*) are simply small enlargements at the ends of two long coiled tubes (*AGlD*), which latter unite into a short single tube that opens into the anterior end of the great poison sac (*Psn Sc*). The secretion of these glands is acid. The third gland (*BGl*) is a short, somewhat twisted tube opening into the bulb of the sting along with the poison sac. Its secretion is alkaline. Carlet has shown that it is only the mixture of these two secretions that has the full strength in stinging properties.

The alimentary canal (Fig. 6) consists of a tube extending through the entire body, and coiled somewhat in the abdomen. The first part above the mouth in the head is widened to form the *pharynx* (*Phy*). Then follows the long slender *oesophagus* (*Œ*), running clear through the thorax and into the front of the abdomen, where it enlarges into a thin-walled bag, called, in general, the *crop,* but which is known as the *honey stomach* (*HS*) in the bee. Back of the honey stomach is a short narrow *proventriculus* (*Pvent*), which is followed by the large U-shaped stomach, or *ventriculus* (*Vent*). Then comes the slender *small* in-

testine (*SInt*) with the circle of *Malpighian tubules* (*Mal*) arising from its anterior end. Finally, forming the terminal part of the alimentary canal, is the *large* intestine, or *rectum* (*Rect*), consisting of an enormous sac, varying in size according to its contents, but often occupying a large part of the abdominal cavity. Six opaque longitudinal bands on its anterior end are known as the *rectal gland* (*RGl*).

The honey stomach is of special interest in the worker because the nectar gathered from the flowers is held in it, instead of being swallowed on down into the stomach, and is regurgitated into the cells of the comb, or given up first to another bee in the hive. The upper end of the proventriculus sticks up into the lower end of the honey stomach as a small cone with an X-shaped opening in its summit. This opening is

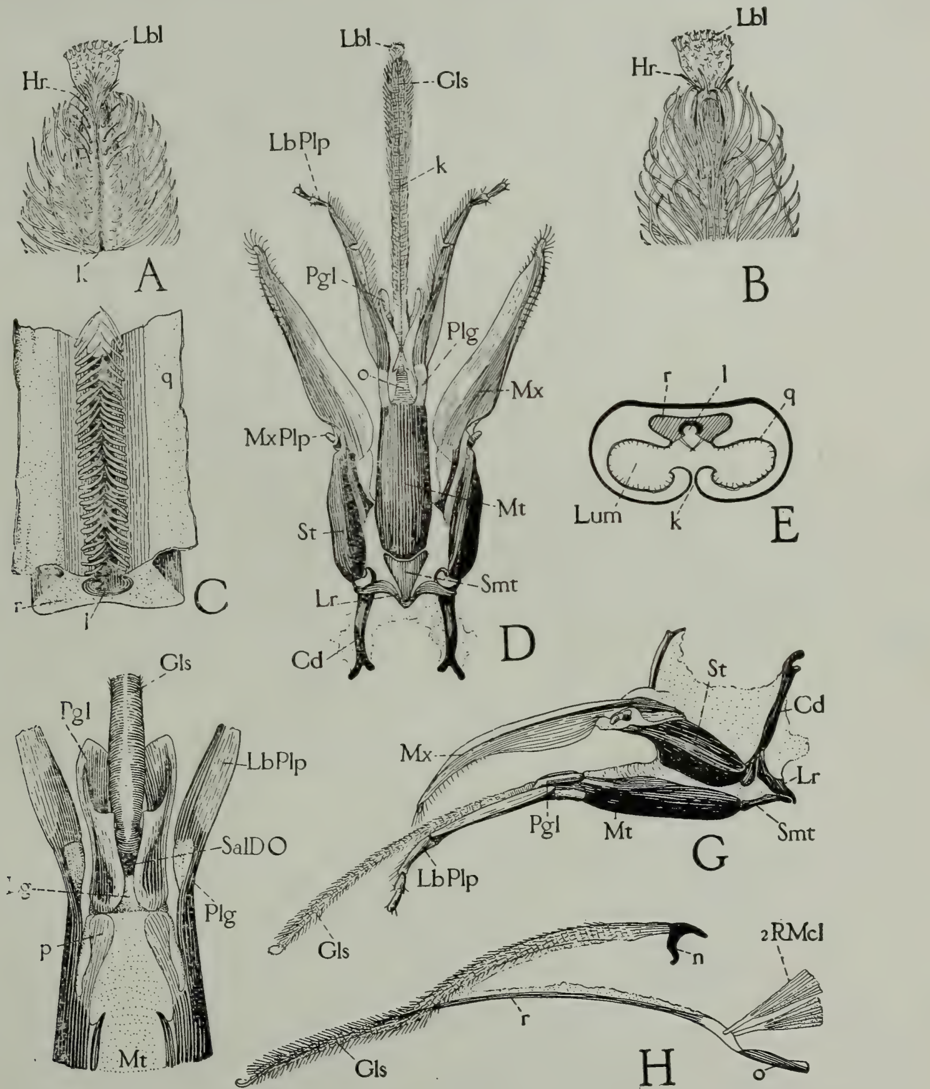

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FIG. 3.—Details of mouth parts of worker. *A*, tip of glossa, ventral; *B*, tip of glossa, dorsal; *C*, piece of glossal rod (*r*) showing ventral groove (*l*) with parts of wall (*q*) of glossal channel attached; *D*, parts of proboscis (maxillæ and labium) flattened out in ventral view; *E*, cross-section of glossa, showing its channel (*Lum*) open below along the groove (*k*), the internal rod (*r*) in roof of channel, and its groove (*l*); *F*, distal end of mentum (*Mt*), dorsal, showing opening of salivary duct (*SalDO*) on base of ligula; *G*, lateral view of left half of proboscis; *H*, glossa (*Gls*) with its rod (*r*) partly torn away, showing retractor muscles (*2RMcl*) attached to its base; *Cd*, cardo; *Hr*, long stiff hairs near tip of glossa; *k*, ventral groove of glossa; *l*, ventral groove of glossal rod; *Lbl*, labella; *LbPlp*, labial palpus; *Lg*, ligula; *Lr*, lorum; *Lum*, channel in glossa; *Mt*, mentum; *Mx*, terminal blade of maxilla; *MxPlp*, maxillary palpus; *n*, basal process of glossal rod; *o*, ventral plate of ligula, carrying base of glossal rod; *p*, dorsal plates of mentum; *Pgl*, paraglossa; *Plg*, palpiger; *q*, inner wall of glossal channel; *r*, rod of glossa; *2RMcl*, retractor muscle of glossal rod; *SalDO*, opening of salivary duct; *Smt*, submentum; *St*, stipes.

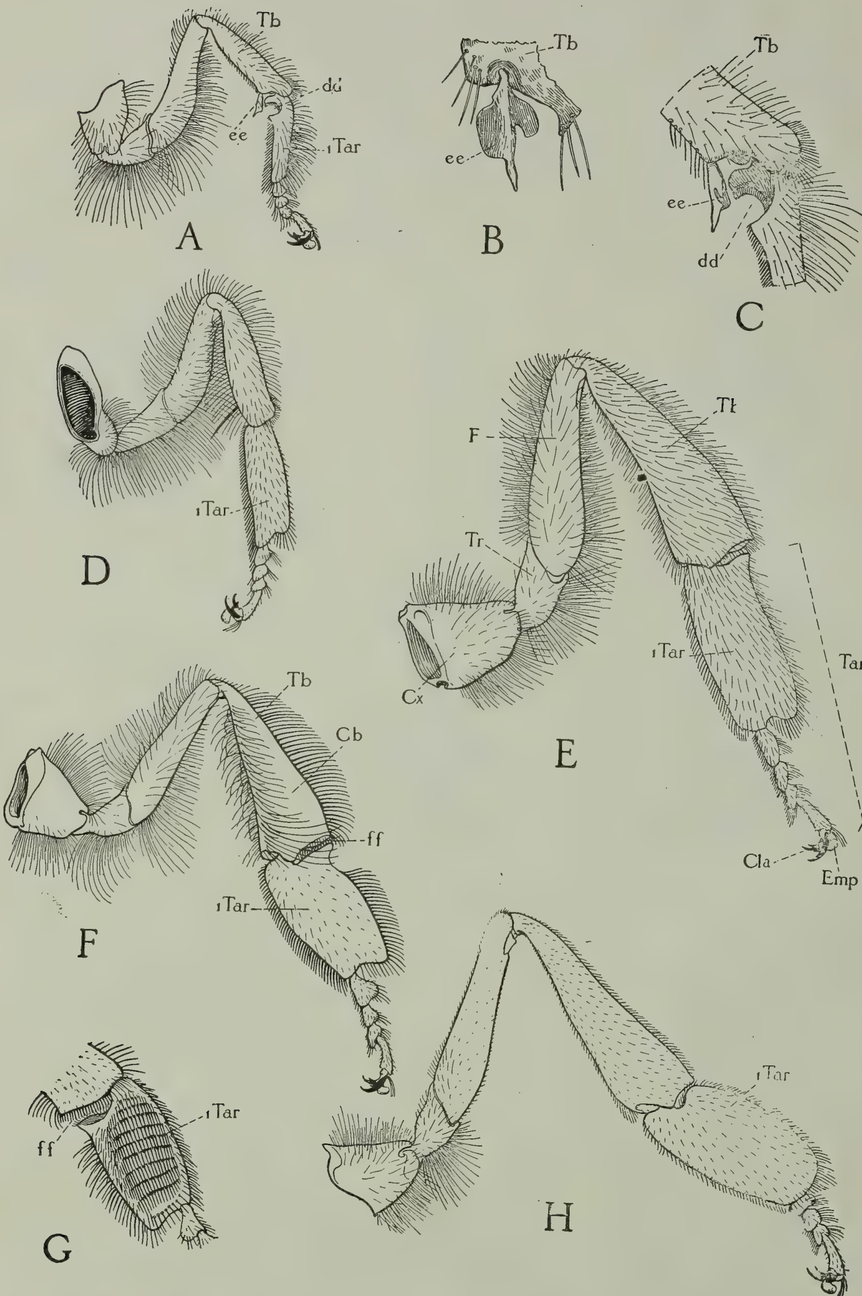

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FIG. 4.—Details of legs. *A*, front leg of worker, showing position of antenna-cleaner (*dd* and *ee*); *B*, end of tibia of front leg showing spine (*ee*) of antenna-cleaner; *C*, antenna-cleaner, more enlarged; *D*, middle leg of worker; *E*, hind leg of queen; *F*, hind leg of worker, showing pollen-basket (Cb) on outer surface of tibia; *G*, inner view of basal joint of hind tarsus of worker, showing the brush of pollen-gathering hairs; *H*, hind leg of drone; *Cb*, corbiculum, or pollen-basket; *Cla*, claws; *Cx*, coxa; *dd*, notch of antenna-cleaner on basal joint of first tarsus; *ee*, spine of antenna-cleaner on distal end of tibia; *Emp*, empodium, sticky pad between the claws for walking on smooth surfaces; *F*, femur; *ff*, "wax shears;" *Tar*, tarsus; *1Tar*, first joint of tarsus; *Tb*, tibia.

called the *stomach mouth*. Its four lips are very active, and take whatever food the ventriculus requires from the honey stomach, for it must all go into the latter first, while at the same time it affords the bees a means of retaining nectar or honey in the honey stomach.

The natural food of bees consists of pollen, nectar, and honey. The first contains the nitrogen of their diet, and the other two the hydrogen, carbon, and oxygen. Observations made by the writer indicate that the pollen is not digested until it gets into the intestine, for masses of fresh-looking grains nearly always appear in the rear part of the ventriculus, which is otherwise filled with a brownish slime. On the other hand, the nectar and honey are very probably digested in the ventriculus, and in large part absorbed from it.

The *salivary glands,* located in the back part of the head (Fig. 6, *2Gl*) and in the front part of the thorax (*3Gl*) open upon the upper part of the labium (Fig. 3, F, *SalDo*). The saliva can thus affect the liquid food before the latter enters the mouth, or it can be allowed to run down the proboscis upon hard sugar in order to dissolve it, for the latter is eaten with the proboscis, not with the mandibles.

The large glands (Fig. 6, *1Gl*) situated in the front part of the head are supposed, by some students of the bee, to form the white pasty brood food and the royal jelly. Others think that these substances come from the stomach. More investigation of the subject must be made, however, before the question can be decided; but the contents of the stomachs of workers have no resemblance to the brood food.

The *circulatory* system is very simple, consisting of a delicate, tubular, pulsating *heart* (Fig. 1, *Ht*) in the upper part of the abdomen, of a single long blood vessel, the *aorta* (*Ao*), extending forward from the heart through the thorax into the head, and of two pulsating membranes, the *diaphragms* (*DDph* and *VDph*), stretched across the dorsal and ventral walls of the abdomen, but leaving wide openings along their sides between the points of attachment. The heart consists of four consecutive chambers, (*1ht-4ht*), which are merely swellings of the tube, each having a vertical slit or *ostium* (*Ost*) opening into each side.

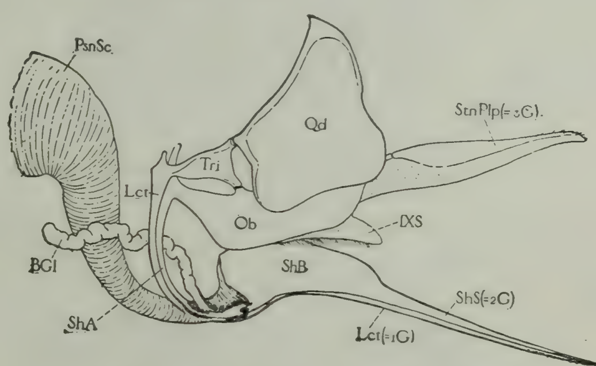

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FIG. 5.—Left side of sting and its accessory plates, with alkaline gland (*BGl*) and base of poison-sac (*PsnSc*) attached. *BGl,* alkaline-poison gland; *Lct,* lancet; *Ob,* oblong plate; *PsnSc,* base of poison-sac, holding secretion from acid-gland (see Fig. 8); *Qd,* quadrate plate; *IXS,* median part of ninth abdominal sternum; *ShA,* arm of sheath; *ShB,* bulb of sheath; *ShS,* shaft of sheath; *StnPlp,* palpus of sting; *Tri,* triangular plate.

The *blood* is the colorless liquid that fills the spaces about the viscera of the body cavity. The dorsal diaphragm and the heart pulsate forward. The blood in the cavity above the former enters the ostia of the heart, and is pumped forward through the aorta and out into the cavity of the head. From here it percolates back through the thorax and enters the space beneath the ventral diaphragm (*VDph*) of the abdomen. This membrane pulsates backward, and the blood is driven posteriorly and upward, through the lateral openings, around the abdominal viscera, and again into the dorsal or pericardial cavity of the abdomen, where it begins its circulation anew. In insects the principal function of the blood is to distribute the food which dissolves into it from the alimentary canal.

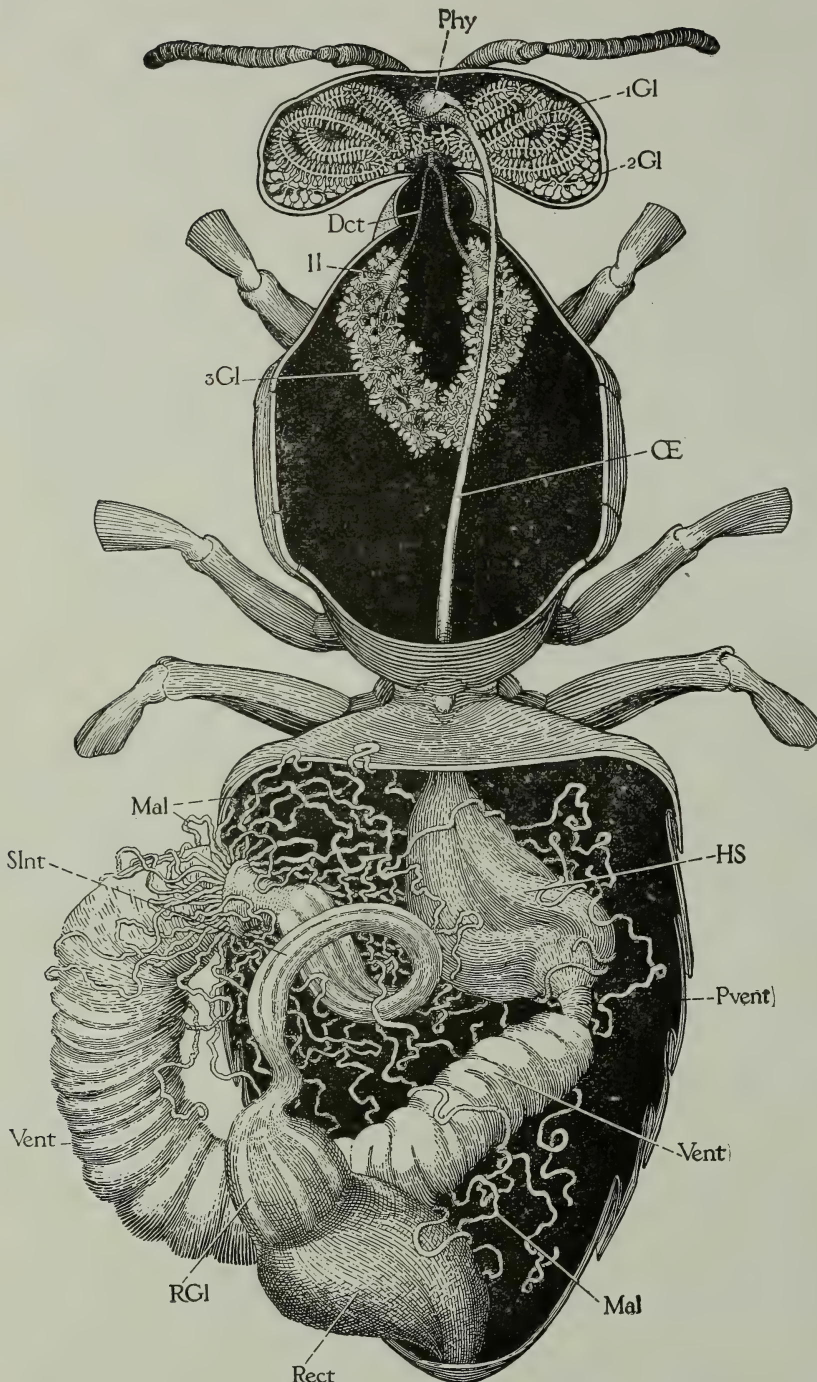

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Fig. 6.—Alimentary canal and salivary glands of worker, dorsal. *Dct*, salivary duct; *1Gl*, pharyngeal glands of head (supracerebral glands); *2Gl*, salivary glands of head (postcerebral glands); *3Gl*, salivary glands of the thorax; *HS*, honey-stomach; *ll*, reservoir of thoracic salivary gland; *Mal*, Malpighian tubules; Œ, œsophagus; *Phy*, pharynx; *Pvent*, proventriculus; *Rect*, rectum; *Rgl*, rectal glands; *SInt*, small intestine; *Vent*, ventriculus.

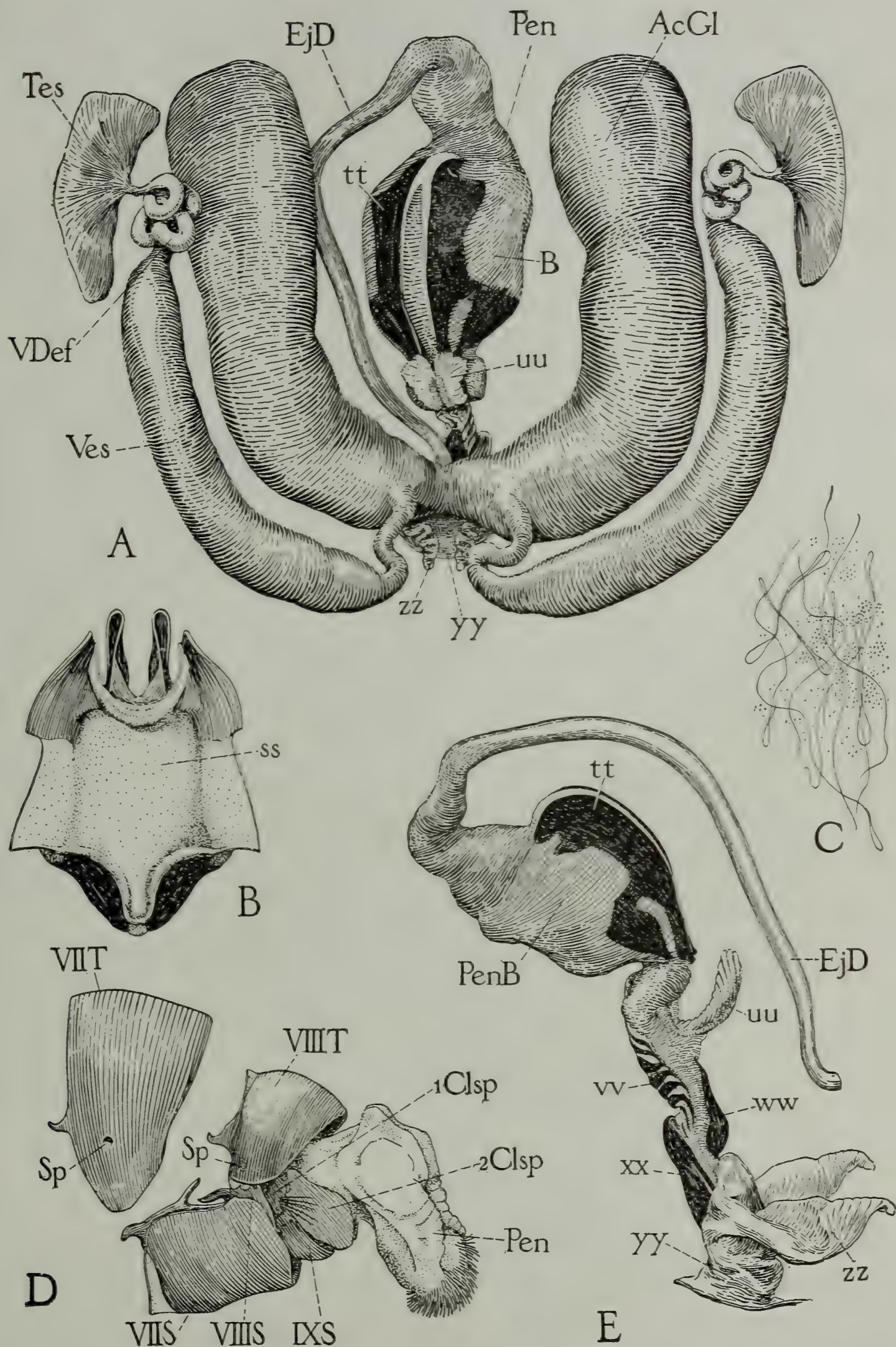

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FIG. 7.—*A*, reproductive organs of drone, dorsal; *B*, inner view of dorsal wall of penis; *C*, group of spermatozoa; *D*, terminal segments of drone, lateral, showing penis (*Pen*) partly protruded; *E*, lateral view of penis and ejaculatory duct (*EjD*); *AcGl*, accessory mucous gland; *B*, bulb of penis; *1Clsp*, *2Clsp*, clasping organs of ninth abdominal sternum; *Pen*, penis; *PenB*, bulb of penis; *VIIS-IXS*, seventh to ninth abdominal sterna; *ss*, gelatinous mass of inner wall of bulb of penis; *VIIT-VIIIT*, seventh and eighth abdominal terga; *tt*, dorsal plates of bulb of penis; *Tes*, testis; *uu*, fimbriated lobe at base of bulb of penis; *vv*, ladder-like plates of penis; *VDef*, vas deferens; *Ves*, seminal vesicle; *ww*, *xx*, dorsal and ventral plates in wall of penis; *yy*, terminal chamber of penis through which the rest is everted; *zz*, copulatory pouches of penis.

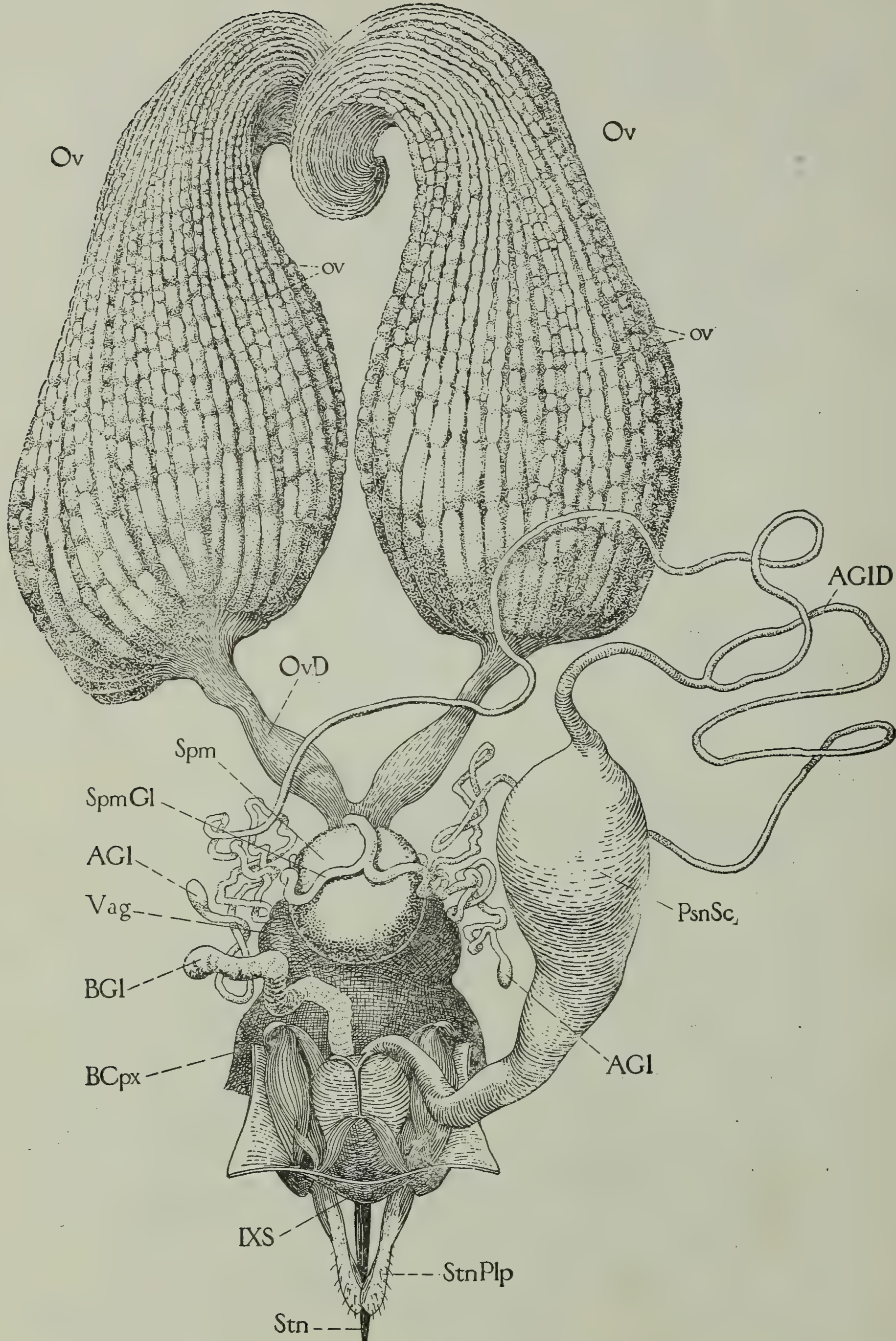

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Fig. 8.—Reproductive organs of queen, dorsal, together with sting, its muscles, glands, and poison-sac. *AGl*, acid-glands of sting; *AGlD*, duct of acid-glands; *BCpx*, bursa copulatrix; *BGl*, alkaline gland of sting; *Ov*, ovaries; *ov*, ovarioles; *OvD*, oviduct; *PsnSc*, poison-sac; *IXS*, median part of ninth abdominal sternum; *Spm*, sac of spermatheca; *SpmGl*, spermathecal gland; *Stn*, sting; *StnPlp*, palpus of sting; *Vag*, vagina.

The *respiratory system* is very highly developed in the bee, consisting (Fig. 1) of large air sacs (TraSc, *1-10*) in the head, thorax, and abdomen, and of tubes called tracheæ given off from them (*Tra, LTra*). Fig. 1 shows principally the parts in only the right side of the body. In the abdomen a large sac (*10*) lies on each side connected with the exterior by short tubes opening on the sides of the first seven segments. Three other pairs of such openings occur in the thorax; but the last of these, being in the propodeum, really belongs to the abdomen. Thus there are in all ten pairs of breathing apertures, and they are called the *spiracles*. None occur on the head. The tracheal tubes given off from the air sacs branch minutely to all parts of the body and penetrate into most of the tissues. Hence oxygen is carried directly to the cells that use it, and the blood of insects is thus relieved of the work of distributing it—one of its principal functions in vertebrate animals. The respiratory movements are produced by muscles of the abdomen.

The life processes of the cells of the body result in the formation of products excreted by the cells into the surrounding blood. These products are poisonous to the system unless immediately changed into simpler substances. This change is effected partly by the inhaled oxygen combining with the waste products, resulting in the formation of compounds of nitrogen which dissolve in the blood, and of carbonic acid gas which diffuses into the tracheal tubes and is exhaled. The nitrogen compounds are supposed to be removed by the *Malpighian tubules* (Fig. 6, *Mal*), which are regarded as the kidneys of insects.

The *nervous system* consists of a series of small masses of nerve tissue called *ganglia,* lying along the median ventral line of the body cavity (Fig. 1, *1Gng-7Gng*), the two of the thorax being much larger than those of the abdomen. Each two are connected by a pair of cords called *commissures.* Nerves are given off from these ganglia to the various organs and parts of the body, and to the legs and wings. In the head there are two ganglionic masses. One is called the *brain* (*OpL*), and is situated above the œsophagus, where it gives off nerves to the eyes, the antennæ, the front, and the labrum. The other, called the *suboesophageal ganglion,* lies in the lower part of the head, and innervates the mouth parts, while it is connected by commissures with both brain and the first thoracic ganglion.

The *reproductive system* consists of those organs that produce the spermatozoa in the male and the eggs in the female and their accessory parts.

The spermatozoa are formed in the *testes* of the male (Fig. 7, A, *Tes*), a pair of small bodies in the front part of the abdomen, said to be developed at their highest in the pupal stage. Each is connected by a coiled tube, the *vas defferens* (*VDef*), with a long sac, the *seminal vesicle* (*Ves*) in which the spermatozoa are stored during the adult stage of the drone's life. The two vesicles open into the bases of two enormous *mucous* glands (*AcGl*) which come together in a narrow muscular tube, the *ejaculatory duct* (*EjD*). This opens into the anterior end of the *penis* (*Pen*). This is a complicated organ, shown at E, Fig. 7. It is ordinarily contained within the cavity of the abdomen; but during copulation it is entirely everted, and its basal pouches (*zz*) lock into corresponding pouches of the oviduct of the queen.

The eggs are formed by the *ovaries* of the female (Fig. 8, *Ov*), each of which consists of a thick mass of tubules called the *ovarioles* (*ov*), within which the eggs grow from simple cells at their upper ends into the mature eggs found at their lower ends. The ovarioles of each oviary open into an *oviduct* (*OvD*), which two unite into a wide median tube called the *vagina* (*Va*) that swells posteriorly into a large pouch known as the *bursa copulatrix* (*BCpx*), opening to the exterior in the eighth segment beneath the base of the sting.

During copulation the drone ejects the spermatozoa into the upper end of the vagina of the queen. The spermatozoa consist of minute vibratory threads (Fig. 7, C), which, probably, by their own motion, make their way up through a small tube opening into the dorsal wall of the vagina, and so reach a globular sac (Fig. 7, *Spm*) called the *spermatheca.* Here they are held during the rest of the lifetime of the queen, to be extruded in small bundles, of about a hundred each, according to Breslaw, upon the eggs passing out of the vagina. Thus are the female eggs *fertilized,* the drone eggs developing without the addition of the male element.

ANGER OF BEES.—We do not like the term "anger," when applied to bees, and it almost makes us angry when we hear people speak of their being "mad," as if they were always in a towering rage, and delight to inflict severe pain on everything and everybody coming near them. Bees are, on the contrary, the pleasantest, most sociable, genial, and good-natured little beings we meet in all animated creation, when we understand them. Why, we can tear their beautiful comb all to bits right before their very eyes, and without a particle of resentment; but with all the patience in the world they will at once set to work to repair it, and that, too, without a word of remonstrance. If you pinch them they will sting; and anybody who has energy enough to take care of himself would do as much had he the weapon.

We as yet know very little of bees comparatively; and the more we learn, the easier we find it to be to get along without any clashing in regard to who shall be master. In fact, we take all their honey now, almost as fast as they gather it; and even if we are so thoughtless as to starve them to death, no word of complaint is made.

How to open hives in such a way as to avoid stings, see FRAMES, TO MANIPULATE, and STINGS.

There are a few circumstances under which bees seem "cross;" and although we may not be able to account exactly for it, we can take precautions to avoid these unpleasant features, by a little care. A few years ago a very intelligent friend procured some Italians, an extractor, etc., and commenced bee culture. He soon learned to handle them, and succeeded finely; when it came time to extract, the whole business went on so easily that he was surprised at what had been said about experienced hands being needed to do the work. He had been in the habit of doing his work as directed, toward the middle of the day, while the great mass of the bees were in the fields; but in the midst of a heavy yield of clover honey, when the hives were full to overflowing, they were one day stopped by a heavy thunder shower. This, of course, drove the bees home, and at the same time washed the honey out of the blossoms so completely that they had nothing to do but remain in the hives until more was secreted. Not so with their energetic and enthusiastic owner. As soon as the rain had ceased, the hives were again opened and an attempt made to take out the frames, as but a few hours before; but the bees that were all gentleness then, seemed now possessed of the very spirit of mischief and malice; and when all hands had been severely stung, they concluded that prudence was the better part of valor and stopped operations for the day. While loads of honey were coming in all the while, and every bee rejoicing, none were disposed to be cross; but after the shower, all hands were standing around idle; and when a hive was opened, each was ready to take a grab from its neighbor, and the result was a free fight in a very short time.

There is nothing in the world that will induce bees to sting with such wicked recklessness as to have them get to quarreling over combs or honey left exposed when they have nothing to do. From a little carelessness in this respect, and nothing else, whole apiaries have been so demoralized that people were stung when passing along the street several rods distant. During the middle of the day, when bees were busily engaged on the flowers, during a good yield, we have frequently left filled combs standing on the top of a hive from noon until supper time without a bee touching them; but to do this after a hard rain, or at a time when little or no honey is to be gathered in the fields, might result in the ruin of several colonies, and you and your bees being voted a nuisance by the whole neighborhood.

Almost every season we get more or less letters complaining that the bees have suddenly become so cross as to be almost unmanageable, and those letters come along in July, after the clover and linden have begun to slack up. The bees are not so very unlike mankind after all, and all you have to do is to avoid opening the hive for a few days, until they get used to the sudden disappointments of having avenues through which they were getting wealth so rapidly, cut off. After a week or ten days they will be almost as gentle as in the times when they gathered half a gallon of honey daily, if you are only careful about leaving hives open too long or leaving any bits of honey or comb about.

It is not easy to explain why bees sting so remorselessly and vindictively after having

had a taste of stolen sweets, yet nearly all the experience we have had of trouble with stinging has been from this very cause. Bees from colonies that have a habit of robbing will buzz about one's ears and eyes for hours, seeming to delight in making one nervous and fidgety if they succeed in so doing, and they not only threaten, but often times inflict, the most painful stings, and then buzz about in an infuriated way, as if frantic because unable to sting one a dozen times more after their sting is lost. The colonies that furnish this class of bees are generally hybrid, or perhaps black bees having just a trace of Italian blood. These bees seem to have a perfect passion for following one about, and buzzing before the nose from one side to the other (until one gets cross-eyed in trying to follow their erratic oscillations), in a way that is most especially provoking. One such colony annoyed us so much while extracting that we killed the queen, although she was very prolific, and substituted a pure Italian. Although it is seldom an Italian follows one about in the manner mentioned, yet an occasional colony may contain bees that do it; at least we have found such, where the workers were all three-banded. That it is possible to have an apiary without any such disagreeable bees, we have several times demonstrated; but oftentimes you will have to discard some of your very best honey gatherers, to be entirely rid of them.

On occasions like this it is advisable to use robber traps. See ROBBERS.

With a little practice the apiarist will tell as soon as he comes very near the apiary whether any angry bees are about, by the high keynote they utter when on the wing. It is well known that with meal feeding (see POLLEN) we have perfect tranquillity although bees from every hive in the apiary may be working on a square yard of meal. Now, should we substitute honey for the meal, we should have a perfect uproar, for a taste of honey found in the open air during a dearth of pasturage, or at a time when our bees have learned to get it by stealing instead of honest industry, seems to have the effect of setting every bee crazy. In some experiments to determine how and why this result came about, we had considerable experience with angry bees. After they had been robbing and had become tranquil, we tried them with dry sugar; the quarrelsome bees fought about it for a short time, but soon resumed their regular business of hanging about the well-filled hives, trying to creep into every crack and crevice, and making themselves generally disagreeable all around. If a hive was to be opened, they were into it almost before the cover was raised, and then resulted a pitched battle between them and the inmates; the operator was sure to be stung by one or both parties, and, pretty soon, some of the good people indoors would be asking what in the world made the bees so awfully cross, saying that they even came indoors and tried to sting. Now, why could they not work peaceably on the sugar as they do on the meal, or the clover blossoms in June? We dampened the sugar with a sprinkler, and the bees that were at work on it soon started for home with a load; then began the high keynote of robbing, faint at first, then louder and louder, until we began to be almost frightened at the mischief that might ensue. When the dampness was all licked up they soon subsided into their usual condition. The effect of feeding honey in the open air is very much worse than that of feeding any kind of syrup.

HOW THE SOURCE FROM WHICH BEES ARE GATHERING AFFECTS THEIR TEMPER.

It has been found that bees are crosser when working on some blossoms than on others. For example they seem to be more inclined to sting when working on buckwheat than on clover. This is probably due to the fact that the latter yields nectar all day while the former will in most localities yield an hour or two in the morning and again toward night. The stoppage of the flow seems to affect the bees adversely.

In the same way they are cross when working on honey dew from hickory and oaks. This yields heavily in the morning and lets up and stops during the middle hours of the day. The morning dews soften the saccharine matter secreted on the leaves of these trees, and when it dries up again the nectar supply is cut off and the bees are cross. During 1909, when there was so much honey dew from oaks and hickories from all over the country, bees that year were reported to be exceptionally cross.

To make bees good natured, a honey plant must be a continuous yielder *all day*. So long as it keeps up its supply, there is

quiet. How to make bees good-natured by feeding, see Feeding Outdoors; also see Robbing, Stings, and Frames, to Manipulate.

ANTS. — Although we have given the matter considerable attention, we can not find that ants are guilty of any thing that should warrant, here in the North, the apiarist in waging any great warfare against them. Some years ago a visitor frightened us by saying that the ants about our apiary would steal every drop of honey as fast as the bees could gather it. Accordingly we prepared ourselves with a tea-kettle of boiling water, and not only killed the ants but some grapevines growing near. Afterward there came a spring when the bees, all but about eleven colonies, dwindled away and died, and the hives filled with honey, scattered about the apiary unprotected, seemed to be as fair a chance for the ants that had not "dwindled" a particle, as they could well ask for. We watched to see how fast they would carry away the honey, but, to our astonishment, they seemed to care more for the hives that contained bees than for those containing only honey. We soon determined that it was the warmth from the cluster that especially attracted them; and as the hives were directly on the ground, the ants soon moved into several that contained only a small cluster and for a while both used one common entrance. As the bees increased, they began to show a decided aversion to having two families in the same house, although the ants were evidently inclined to be peaceable enough until the bees tried to "push" matters, when they turned about and showed themselves fully able to hold possession. The bees seemed to be studying over the matter for a while, and finally we found them one day taking the ants, one by one, and carrying them high up in the air, and letting them drop at such a distance from their home that they would surely never be able to walk back again. The bees, as fast as they became strong colonies, drove the ants out; and our experience ever since has been, that a *good* colony of bees is never in any danger of being troubled in the least by ants. One weak colony, after battling a while with a strong nest of the ants, swarmed out; but they might have done this any way, so we do not lay much blame to the ants.

But ants do prove to be very annoying in those apiaries where there is any attempt to keep the grass down with a lawn-mower. The little hillocks that they make all over the yard disfigure it to some extent, as well as forming more or less obstruction to the scythe and lawn-mower. While, as we have already said, ants do little if any damage to hives in the North, yet as it is so easy to eradicate them it may be well to consider methods for their extermination.

HOW TO DESTROY ANTS' NESTS.

With a crowbar or a short stick and a mallet make a hole an inch or so in diameter, and about a foot deep, down through the center of the nest. Around this hole make two or three other similar ones, or more if the nest is a large one. Go to the drugstore and get about a dime's worth of bisulphide of carbon. Be careful with the stuff, for it is very explosive, and the fumes of it should not be allowed to collect in the room where there is a gasoline flame or any stove or lamp burning. From this bottle pour about a tablespoonful of the liquid in each hole; then immediately stop each up with a plug of earth, for it is desired to have the fumes of the bisulphide penetrate all the galleries of the nest, thus destroying ants, larvæ, and eggs. In a day or so it will be found that every thing formerly animate in and about the nest is dead—*very* dead.

But if the nests are not very large, one can secure almost as good results by using coal oil or gasoline in place of the bisulphide. But in using these, about twice or three times the quantity should be poured in each hole. We have tried both gasoline and kerosene, and have found each effective in destroying the nest. Of the two, the kerosene (or coal oil, as some call it) seems to be preferable. In using bisulphide of carbon, gasoline, or kerosene, be careful about spilling or pouring any of it on the top of the nest, as that will kill the grass, leaving a brown spot right where it should be green. The bisulphide is more apt to kill the grass than the gasoline or coal oil, as it is much more powerful. All things considered we would recommend the use of kerosene.

The best time to destroy ants' nests is to go early in the spring, before the ants have had an opportunity to make much of a hil-

lock; then there will be less liability of killing the grass; or, rather, a better opportunity for the grass to recover from its "dose" during the early spring rains.

ANTS IN THE SOUTH.

These insects are much more troublesome in the Southern States, and all warm climates, in fact, than in the North. Sometimes they are so large and powerful that they even set about to destroy the colony. We would first find the nest, and proceed to destroy by the use of kerosene or gasoline. If these do not prove to be powerful enough, use bisulphide of carbon, making three or four holes to the square foot of nest; but in the case of the bisulphide, one must be careful to have each hole stopped up tight with plugs of earth, otherwise the gas will escape, and the effect of the liquid will be largely lost.

But there is a species of ants in warm climates that have nests in trees that are inaccessible. Other ants are so small, and come such long distances, that it is almost impossible to find their nest. In such cases it has been recommended to place within their reach some syrup or honey mixed with arsenic, Paris green, London purple, or strychnine. It is unnecessary to say that all vessels containing such poisonous mixtures should be placed in a box covered with screen just fine enough to keep out bees, and coarse enough to admit the ants. They will work on these poisonous mixtures, and carry them home to their young, with the result that both mature insects as well as larvæ will be destroyed, no matter where the nest may be.

E. H. Schæffle, of Murphys, California, who recommends this method of feeding ants with poisoned sweets, says the plan is very effective, for their visitations will soon cease. But he stipulates that the box containing the poisonous sweet should be put in the trail of the ants. When it does not seem practicable to destroy the pests they may be kept away from the hive temporarily by pouring a little narrow trail of kerosene clear around the hive or hives. The ants will come up to the oily line, and there stop.

Mr. Poppleton, of Florida, has graphically described in *Gleanings* the

CARNIVOROUS ANTS.

With one exception these ants are the worst enemies bees have here in Florida, and only constant vigilance from September to December inclusive will prevent the loss of many colonies every season. These ants are usually found in our hummock lands, and only occasionally in clean pine woods; are red in color; of very large size; frequently measuring nearly or quite half an inch in length; are strictly nocturnal in their habits, being seldom seen in daytime except when disturbed or waging battle with a colony of bees; are usually found in decayed wood, through which they cut out galleries for use as living-apartments. A favorite place is in a saw-palmetto root in the ground. Nearly every cabbage-palmetto tree contains a colony of them among the boots near its top, and for this reason a thick palmetto grove is one of the worst places an apiary can be located. They are also found in piles of old boards, and on the ground under old boards or logs. They also like to enter our houses and locate in trunks, boxes, drawers, and in almost any place where they can find a few inches of space to occupy. They are frequently found in the tops of our hives if there is sufficient space above the bees under the cover.

At sundown they start on their nightly quest for food; and if near an apiary a few of them will usually be seen running on some of the hives. As long as only two or three can be seen on any one hive, no special attention need be given them; but if a dozen or more are seen it means that they have probably selected that hive for their own use, and it needs close watching. They will continue their regular attentions to that one hive, gradually increasing in numbers until they decide they are strong enough, when nearly the entire colony of ants will boldly attack the bees by biting off their wings and legs, and crippling them so they are of no more use. Bees fight back courageously, the battle continuing for hours, and sometimes a day or two, according to the relative strength of the two belligerents. The inside of the hive and the ground near by will be strewn with dead ants and dead and crippled bees; but it always ends with the destruction of all the bees, and the moving in and occupation of the hive by the ant colony. When ants have once chosen a certain colony of bees to work on, the beemaster has *got* to destroy the ants, root and branch, or they will in time destroy the bees. If a part only of the ants are destroyed they will simply bide their time until they have built up strong enough, and then do the work. I know of few or no living creatures more persistent in evil works than are these bee-killing ants. They also, in certain localities, do great damage to queen-rearing nuclei.

During the fall months I make it a practice almost every evening after dark in my home apiary, and as often as possible in the out-apiaries, to see by the light of a lantern the front of every hive; and any one on which I see three or four or more ants running over has a mark placed on it. If the number of ants on any one of these marked hives increases each night I give that hive special attention until the ants get numerous enough to begin to worry the bees. When this occurs, bees commence to whine, as I call it—that is, utter a fine sharp note with their wings. As the ants get bolder the cry of the bees becomes louder and more frequent—so much so that I have frequently heard it fifty feet away. The ants usually worry the bees continually for several nights, when suddenly the whole colony of ants starts in on a battle royal, which continues for hours or even a day or two, until every bee is disabled or driven out. A great many of the ants will also be killed; but how the bees do this is a mystery to me.

When the battle has once been joined, the beekeeper has a difficult task to save the bees; but this can usually be prevented. When the ants become plentiful enough at the hive to begin worrying the bees, there is usually a trail of going and returning ants from their nest to the hive, and this can usually be located and traced to their nest, which, when found, should be left undisturbed until the following

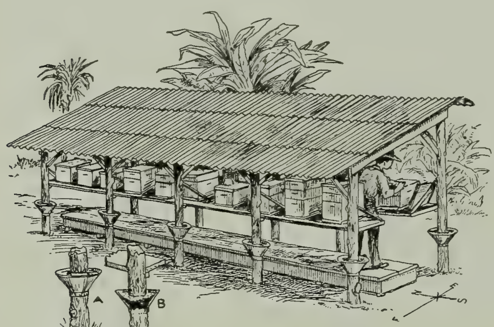
day, when all the ants will be at home. If the nest can not be found the first time trying, I search again until it is found. As soon as the nest is found, or search for it is given up for that night, I sprinkle some insect powder on their trail near the hive; also wherever on or around the hive I can do so to worry the ants and not injure the bees. This will usually keep the ants from doing any more harm that night.

The next day when all the ants are at home, I take a kettle of boiling water, tear open the nest, and, if possible, kill every ant and egg. If a few of them are left they are likely to gather together, increase in time to their former strength, and again attack that same colony of bees. Whenever the nest is found in a box or piece of wood that can be easily moved with all the ants, the easiest and best plan is to carry them into the chicken-yard, break open the nest, and the hens will gladly do the rest of the business. They are very fond of both ants and eggs; and they not only find them good to eat, but give their owner lots of fun watching the old rooster especially, kick and scold every time an ant bites one of his feet. I have had many a hearty laugh watching this performance.

These ants are a great pest here in Florida. They destroy in the aggregate a great many colonies every fall. I know of one apiary which was entirely lost, largely, I judge, from what I hear, by these ants. At the best they are a great nuisance because they compel the beekeeper to remain at home watching them at a season of the year when nothing is doing in the apiary, and the apiarist could, but for them, be away on a holiday, or have some outside business.

Stuart, Fla., Dec. 9, 1905. O. O. POPPLETON.

Ants are a serious pest to bees in many tropical countries, notably in South America, where they are omnipresent and almost omnipotent. A species similar to that described by Mr. Poppleton in Florida exists all over tropical America, and particularly



Morrison's ant-proof beehive shed.

in the Southern continent. He has so graphically described it, there is no necessity to enlarge on it further. The worst feature of these ants is their readiness to travel, so that, when one does destroy their nests, there is no assurance the apiary is safe from their attacks. Another bad feature is their habit of traveling by night; in fact, nearly all their depredations are made in the dark.

To circumvent them it is necessary to destroy all their nests within a radius of 100 yards of the apiary by the application of bisulphide of carbon to their nests. But this precaution alone will not suffice, and it will be necessary to adopt further measures. Luckily it is not difficult to do this, as tropical beekeepers are obliged to keep their hives under a shed, for excellent reasons.

In erecting a shed, therefore, we can take measures to prevent effectually the ants having access to the hives at all. All we have to do is to add cups to all the posts used to support the structure. The illustration preceding, shows very clearly how this is accomplished with but little expense or trouble. The cups are filled with coal-tar, creosote, or crude petroleum, all of which the ants positively dislike for two reasons—they stick to their feet and the smell is vile. No ant will attempt to cross such a mess as this, hence the bees are secure. The warm climate keeps the tar, etc., always soft; and if some rain falls into the cups it does no harm, as the water also tastes of the tar.

In working with the bees care should be taken to see nothing is left which will form a "bridge" whereby the ants will manage to reach the beehives while the apiarist is absent. One of the worst things that can happen is to allow the ants to get a taste of the bees; for once they do they are sure to linger around waiting for an opportunity to get into the hive.

APIARIST.—One who keeps bees, or a beekeeper; and a plot of ground including hives, bees, etc., is called an

APIARY.—As you can not well aspire to be the former until you are possessed of the latter, we will proceed to start an apiary.

LOCATION.

There is scarcely a spot on the surface of the earth where mankind finds sustenance that will not, to some extent, support bees, although they may do much better in some localities than in others. A few years ago it was thought that only localities especially favored would give big honey crops; but since the introduction of modern races, and the new methods of management, we are each year astonished to hear of great yields here and there, and from almost every quarter of the globe. It will certain-

ly pay to try a colony or two of bees, no matter where you may be located.

Bees are kept with much profit, even in the heart of some of our large cities. In this case the apiary is usually located on the roof of the building, that the bees may be less likely to frighten nervous people and those unacquainted with their habits. Such an apiary should be established like those on the ground in all essential points.

It is not always possible to select just the location for an apiary that we might like, and we are therefore compelled to take what we can get; but where conditions permit it is advisable to select the rear of a village lot; or, if located on a farm, back of the house in an orchard. The ground should be rolled and smoothed down so that a lawnmower can run over every portion of it, as the grass should be kept down around the hives. And then, a smooth plot of ground renders the use of a wheelbarrow

THE AUTHORS' APIARY IN CUBA.

Some eight or ten years ago we owned and operated an apiary in Cuba, the same run for honey as well as bees and queens; but the poor seasons finally compelled us to abandon it. . . The hives here shown are in straight rows and close together. Experience showed that this was a mistake, for there were no distinguishing objects by which the bees could mark their homes, and as a result there was more or less confusion and robbing.

THE ROOF APIARY OF C. H. W. WEBER, CINCINNATI, OHIO.

In cities bees are often put on the roofs of the buildings. In all such cases it is advisable to provide shade, for the heat of the summer will be intense in hot weather. If the roof becomes too hot for comfort it is advised to paint it white.

SNAPSHOTS OF THE AUTHORS' HOME APIARY IN WINTER.

The colonies are either in double-walled hives or single walled with an outside winter case slipped over. Upper right-hand view shows a case made of building-paper.

HOME APIARY OF THE AUTHORS IN SUMMER.

This photo shows the windbreak of evergreens surrounding the yard. The house apiary is shown in the background, the upper story of which is used as a workshop. A trellis of grapevines is placed in front of each hive. In summer there is ample shade, and in the fall and early spring the leaves are shed, leaving plenty of sun to strike the hives when it is most needed.

APIARY OF J. WEBSTER JOHNSON, TEMPE, ARIZONA.
This method of shading an apiary in Arizona, where the temperature during the hottest weather often goes above 100 degrees, is almost universal. The roof consists of dried grass or leaves laid on top, and secured by wires laid over the whole.

or handcart for handling loads much more pleasant and convenient. An ideal spot would be an orchard of young trees seventy-five or a hundred feet from the road or highway. Usually the rear end of a village lot just back of the house will answer very nicely. If the apiary *must* be located close to the highway, then a high board fence should be placed between the bees and the street. A hedge of osage orange, or evergreens; a trellis of some sort of vine; trees, shrubbery, or any thing that will cause the bees to raise their flight to a height of ten or twelve feet above the traffic of the street should be used. In any case, the bees should never be allowed to go direct from their hives on a line that would encounter vehicles or pedestrians; otherwise their owner may have a lawsuit on his hands for alleged damages from bee-stings. See Bees as a Nuisance.

TOO MUCH SHADE DETRIMENTAL.

If the orchard where the bees are to be located is made up of *old* trees, then there can be from four to five hives grouped under each tree. If, on the other hand, it consists of young ones, then not more than one or two hives should be placed at a tree, and in that case always on the north side, to be in the shade. The hives should be so located that they will get the morning sun up to eight or nine o'clock, and the afternoon sun from three or four o'clock on. Too much shade is detrimental, and too much hot sun pouring directly on the hives is equally bad. Experience has shown conclusively that a very dense shade over bees in the morning hours is detrimental. Colonies located on the *west* side of a building or barn, or under densely foliaged trees, so that they do not get the morning sun, will not, as a rule, be as far along by the time the honey flow comes on as those that have only moderate shade. On the other hand, an *afternoon* shade does not do as much harm as one in the forenoon.

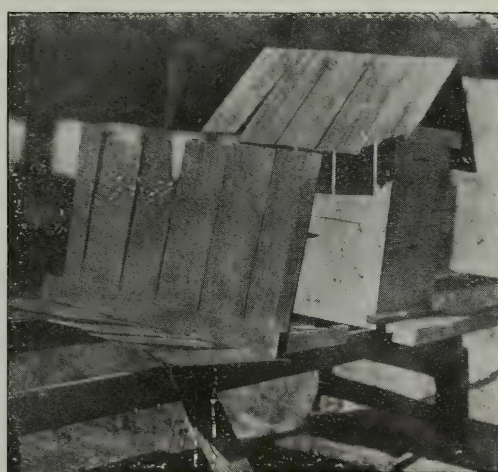
Well, suppose one does not have trees of any sort in his yard—what shall he do? One of four courses lies open: First, to use double-walled hives; second, single-walled hives with shade-boards; third, single-walled hives having on the south side of them some sort of vine that can be reared

SIDE AND END VIEW OF THE SAME APIARY.

The side-braces shown are necessary to prevent a heavy wind from blowing the structure over. It should be noted that these sheds are almost indispensable in hot countries. In dry atmospheres they should be arranged east and west; in the humid they should be placed north and south, to dry out the hives after a tropical rain.

up within a year or two. A grapevine trellis, say 8 feet high and 10 or 12 feet long, running from east to west, well covered with a vine, can be made to protect anywhere from five to ten hives. On this trellis, grapevines or any other quick-growing vine may be reared to provide shade during the heat of the day. The fourth and last plan is to use overhead trellis, making use of straw, dried grass, or brush for covering such as is used in Arizona and Cuba. These trellises are about 7 feet high, and run from east to west,* so that the sun, nearly overhead as it is in Arizona, never strikes the hives from morning till night. These trellised shades, if there are no trees, are indispensable in hot localities. They thoroughly protect the bees, prevent combs melting down, and render the work of the apiarist pleasant.

Some beekeepers prefer to use shade-boards. These may be made of large covers cleated at the ends, and made of two or three boards of the cheapest lumber that can be had, or they may be made of common shingles in the manner shown in the illustrations. Some will, perhaps, prefer

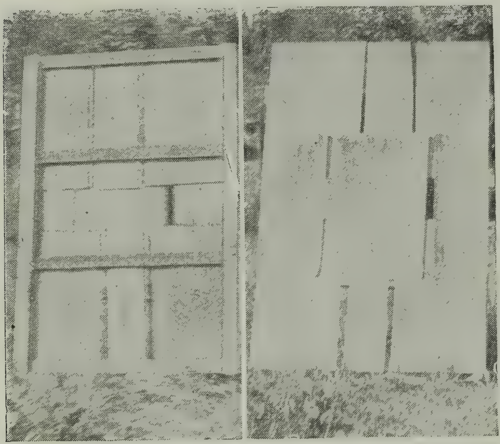


Marchant's shade-board. This provides better ventilation than the ordinary flat shade-board.

them nailed up as Mr. Marchant uses them. Others would prefer to put them together

*In Cuba or other humid countries the sheds should run north and south, for the hives need the sun in the morning and late afternoon to dry them. Protection is required only during the heat of the day when the sun is overhead.

as Mr. Robertson makes them. In some cases it may be advisable to lean them up against the hives rather than to place them on top. When used on top they should be large enough to project a foot over the front and rear, and an equal distance on

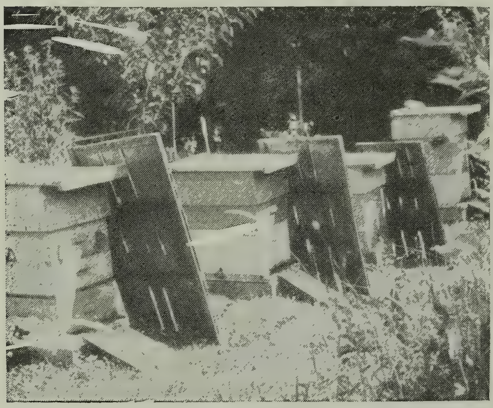


Robertson's shade-boards, constructed of lath and shingles, showing the manner of nailing.

each side. They are then held securely in place by a stone weighing 15 or 20 pounds.

But whenever one manipulates these hives he is required to lift a heavy stone and remove an awkward shade-board before he can do any work with the bees.

When hives are placed in long rows close together, as under a shed or on a roof, it is very essential that the hives differ from each other in appearance so that the bees may distinguish their own hive from all the

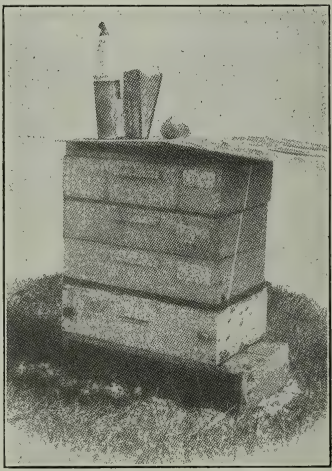


Shading the fronts of the hives and the entrances in the morning.

rest. This differentiation may be accomplished in various ways; first, by painting the hives different colors; second, by using a different entrance or alighting board; third, by laying a stone or brick on some boards and not on others; fourth, by placing a piece of brush on the front of some hives, etc. The idea is to place some distinctive mark by which each hive may be quickly recognized by its tenants. The best way to make such mark is at the entrance so that all the bees can see it, both on leaving and returning.

WINDBREAKS.

The most perfect windbreak is an inclosure of woods on three sides, with an opening to the south. This, however, is not available to all. An apiary so situated that there is a clump of woods on one side and building on the other two sides, leaving only a southern aspect, is well sheltered from the prevailing winds. But, as already stated, if there are woods or buildings around the east side of the beeyard,



Shading tops and fronts of hives during the hottest part of the day.

enough so as to shade the hives until about noon, the bees will not build up as fast in the spring as those that can get the morning sun up to ten or eleven o'clock. In the absence of any natural or accidental protection whatever, it is quite essential that some sort of windbreak be provided. If it is desirable to put up something permanent, and something that would not rot out or require repairs, outskirt the apiary with rows of hardy-growing evergreens, such as are seen in our own apiary in the following pages. These, for the first few years, would afford but a scanty protection; but in 10 years' time they answer their purpose admirably. In 1879 we enclosed our api-

APIARY OF M. H. MENDLESON.

This apiary occupies a very unique position down in the bottom of the canyon, where it is well protected. The ground has been leveled off and terraced, and the rows of hives are straight and parallel. This is one of the most picturesque spots for an apiary in the world. From it some of the best sage honey of California is obtained, and no wonder; for the mountain sage is always in sight and in reach of the bees. The patches of white, black, and button sage on the mountain-sides can be plainly seen.

When the author visited this yard in 1901, he considered it one of the best-located yards in all California —well protected, and the bee-pasturage at close range. But for the fact that there is only about one good yield of honey in five years, this would be a veritable bee-paradise indeed.

THE AUTHORS' APIARY AT JENKINTOWN, PA.

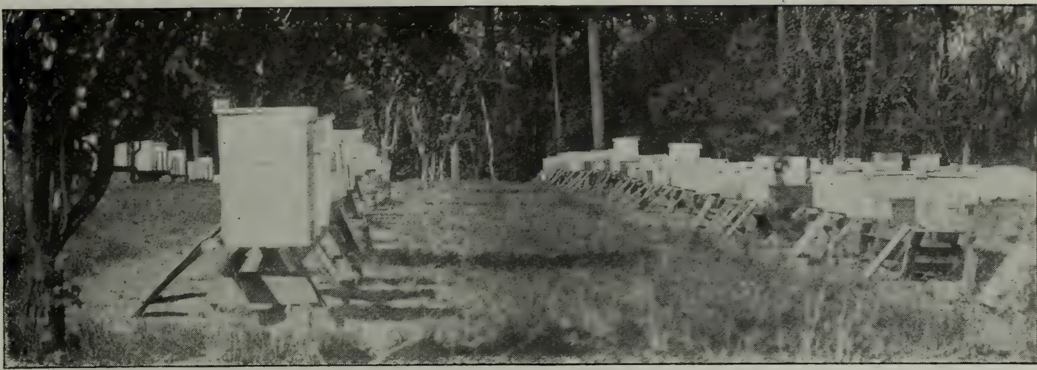
This is an exhibition apiary in the suburbs of Philiadelphia, used to demonstrate the various processes and methods of handling bees. Here are also shown to the visitors the various races, their characteristics and markings.

This yard is intended to be a model one in every respect, and has been so pronounced. The ground is nicely terraced, and here and there are flower-gardens so arranged as to give a pleasing effect.

In June, 1905, and again in 1906, a general field-day of beekeepers was held at this apiary. Experts were present to describe and illustrate their various methods of handling bees, to the crowds that assembled from all over the country. At the field meet of 1906 there were something over 1000 beekeepers present, making by all odds the largest gathering of beekeepers that this country has ever seen. This affair was a success in every way, and it is possible that other meets will be held in this yard in the future.

APIARY OF ERNEST W. FOX, HILLSBORO, WISCONSIN.

This apiary is ideal in that it has a solid windbreak of woods on two sides; of ground gradually sloping toward the bee-cellar, making it easy to get the hives to it. In the spring the colonies will naturally be lighter to carry up hill. This same sloping feature makes it easy to transport the heavy supers to the wagon or honey house on the lower grounds.

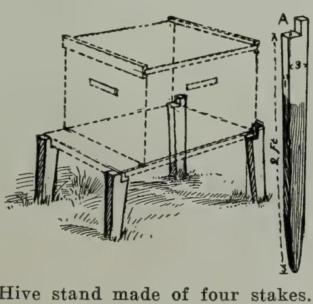


Marchant's home yard of 400 colonies. Along the Appalachicola River as many as 500 colonies can sometimes be supported in one yard. He has had as high as 600.

ary with evergreens. They have proved to be very thrifty, and now are quite good-sized trees.

HIVE STANDS.

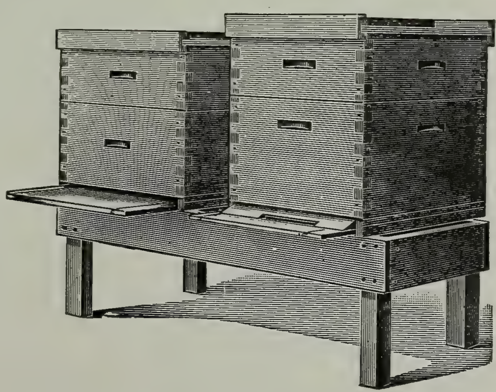
It will be next in order to consider whether we shall put the hives directly on the ground or on some sort of stand. Many beekeepers use four half-bricks, so arranging them that they come directly under the four corners of the bottom board. To secure a proper level, it will be necessary to use a spade or pickax to cut down the soil in spots sufficiently to let one or more bricks come down to the grade of the others. It is desirable, however, to have the forward bricks a little lower than the rear in order that the water may run out of the entrances. Other beekeepers use short strips of old boards or pieces of scantling, cut off in lengths equal to the width of the hive, and leveled in the same manner as the bricks. But the bricks and old boards allow the hives to come too near the ground—enough so to cause dampness, and, sometimes, when the bricks settle, the rotting of the under side of the bottom board.



Hive stand made of four stakes.

Mr. R. C. Hollins, of Sladenville, Ky., drives four notched stakes into the ground, made of stuff three inches wide, one inch thick, and one or two feet long. The part driven into the ground should be dipped in creosote, linseed oil, or, better still, carbolineum, a kind of wood preservative used by railway companies to preserve ties. The illustration here given will show the idea. The stakes should project up above the ground from one to six inches. Four inches will ordinarily be high enough. In that case the stakes need not be more than 18 inches long. The length of them, however, will depend a good deal on the character of the soil and the preference of operator—whether the hive shall be high or low.

The stakes should be driven by line, and accurately measured off, and afterward leveled with a bottom board and spirit-level. If the stakes stick up six inches



Double hive stand.

above the ground it will add greater convenience to the handling of the bees; but in cool spring weather there should be some sort of board reaching from the ground up to the alighting board, so that the bees coming in somewhat chilled may crawl from the ground up into the hive.

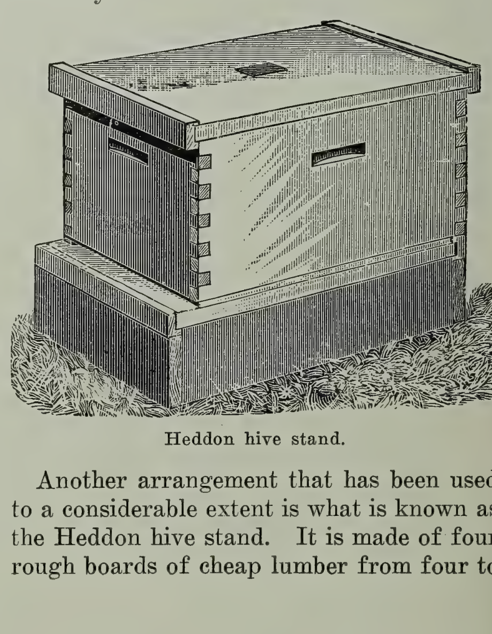
R. L. Tucker's apiary on the Appalachicola River, elevated upon a platform to avoid high water.

Another arrangement that is favored by a good many is a double hive stand made as shown in the illustration, previous page. The legs should not be less than two inches square, and the ends to come in contact with the ground should be dipped in tar, or some sort of wood preservative. The side-boards, if the legs are a foot long, may be anywhere from three to six inches wide—four inches will be a nice compromise. The whole should be securely nailed and made to conform to a level floor. When a sufficient number have been made they can be spaced off and leveled up in the yard ready to receive pairs of hives, or even three if thought necessary.

These arrangements have much to recommend them. They permit keeping the hives in groups of two or three, so they may be operated at convenient distance from the ground. They also allow carrying out the general plan of shaking swarms, as explained further under the head of Swarming; of forming nuclei, or doubling up in the fall. Say there are two hives on the same stand, and both of them weak, and neither of them strong enough to go through the winter. Place all the combs and bees in one hive, and put it in the space exactly between where the two stood. Now move the other hive away entirely. The flying bees of both hives will go back to the one now at a point midway between where the other two stood.

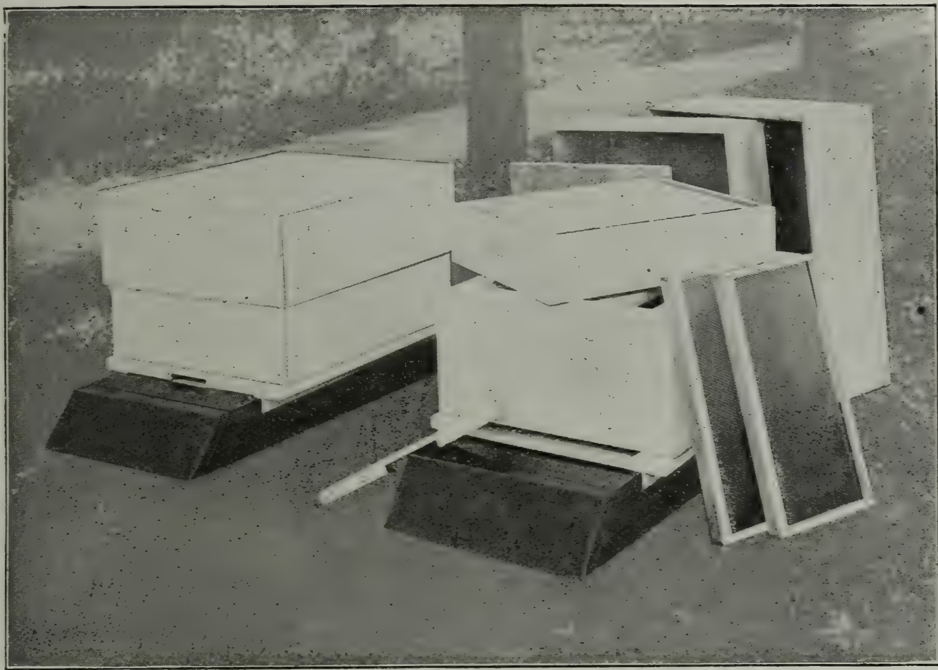
But an important feature of this hive stand is that it permits of being moved from one out-apiary to another without "pulling up stakes;" and a stand that will hold two or three hives is cheaper than two or three separate stands.

If the entrances of the hives are less than a foot above ground it is desirable to have some sort of board leading from the ground up to the entrance, unless the alighting board itself is of good size, as shown at the top of the previous page, in which case the incoming bees will be able to land without difficulty.



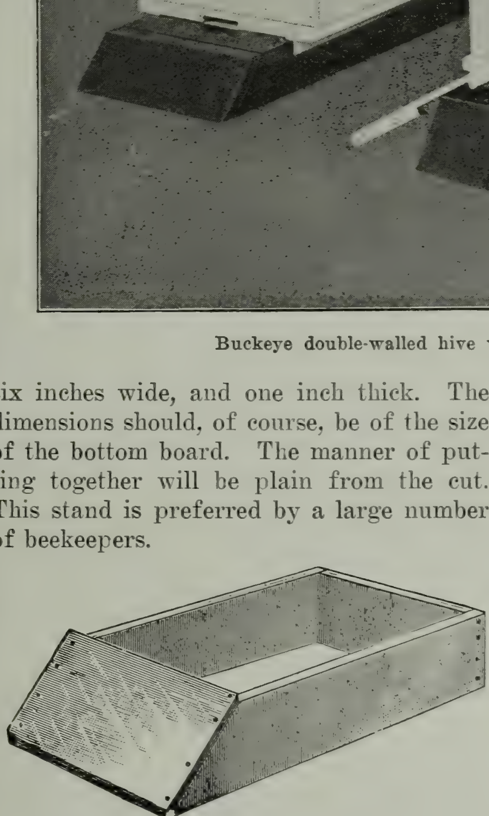
Heddon hive stand.

Another arrangement that has been used to a considerable extent is what is known as the Heddon hive stand. It is made of four rough boards of cheap lumber from four to



Buckeye double-walled hive with a slanting-front hive-stand.

six inches wide, and one inch thick. The dimensions should, of course, be of the size of the bottom board. The manner of putting together will be plain from the cut. This stand is preferred by a large number of beekeepers.



Hive stand with slanting front.

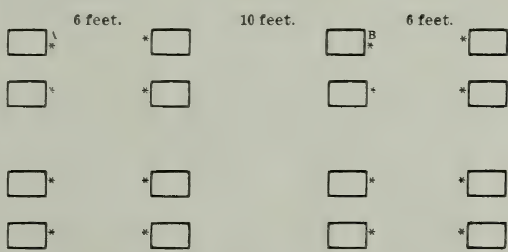
A modified form, and a much better one, is shown in the above two cuts. It has the obvious advantage of a slanting front from the ground to the bottom board.

A few use slabs of concrete. The objections to these are their coldness and the expense.

ARRANGEMENT OF HIVES.

Having decided upon the location, kind of shade, windbreaks, and hive stands, how shall we arrange the hives in the apiary? This question can best be answered by studying the plans adopted by some of the prominent apiarists. The lay of the land and exposure to high winds will, of course, have to be taken into consideration.

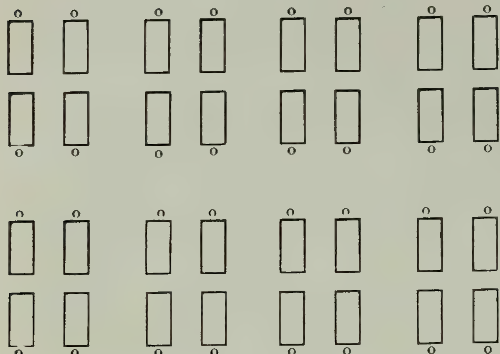
C. A. Hatch, of Ithaca, Wis., a prominent and extensive beekeeper, arranges his hives on the plan shown below, which, as will be seen, will work nicely in connection with the double hive stand shown on a previous page.



A PART OF AN APIARY ARRANGED ON THE STRAIGHT-ROW PLAN.

The stars in the preceding diagram indicate the entrances. There are two lanes, or alleyways, one six feet wide, for the bees, and one ten feet wide, for the apiarist, and his horse and wagon, etc. It will be noticed that the hives are arranged in pairs, in such a way that they face each other with entrances six feet apart. In the next alley their *backs* are toward each other, with plenty of room for a roadway.

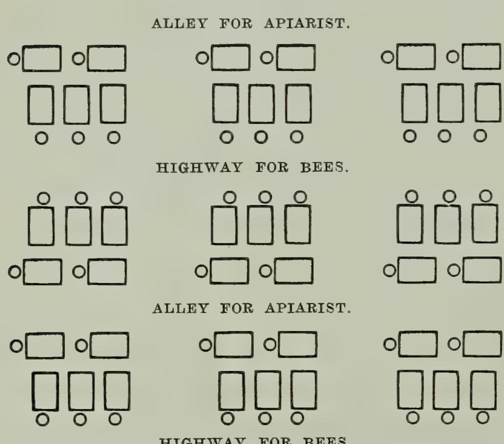
DR. C. C. MILLER'S SCHEME FOR PLACING HIVES.



Dr. C. C. Miller prefers this arrangement. He says it certainly works well for him.

S. E. MILLER'S PLAN OF AN APIARY.

This plan is similar to the one used by Mr. Hatch, but is arranged with a view of still greater economy of space, not losing sight of the scheme of a highway for bees, and an alley for the apiarist. Instead of being in pairs they are arranged in groups of five each. Little circles in front of the

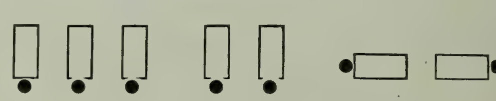


hives indicate the entrances. The hives should be 18 inches apart to give room for a lawnmower. It would hardly do to put them closer than 12 inches, for long timothy grass will grow between them, and then it is difficult to clean it out; and if not cut out it is in the way of putting on the supers. The groups can be from 10 to 20 feet apart; but if put exactly 16 feet apart, and the hives in the group 18 inches apart, an apiary of 80 colonies can be accommodated on a plot 75 feet square, or in the back yard of an ordinary town lot. One advantage of this grouping plan is, that the apiarist can sit on one hive while he is working on another; and his tools, such as smoker, honey knives, bee brushes, etc., are right at hand for the whole five hives. Where there is only one hive on a stand, the tools have to be carried to each hive.

The objection to this and the Hatch arrangement is that one row of hives may have to face prevailing winds, or a north or west exposure. In the northern climates this should be avoided. We recommend, therefore, putting hives in pairs, and facing either the south or east.

One can crowd more colonies on a given area on the S. E. Miller plan shown (and yet leave room to run wagons or carts among the hives), than with any other. It is specially well adapted to a location in a grove; but as trees often vary in size the foliage is sometimes lopsided or scant on some of the trees, and hence it is not always practicable to put five hives at each tree. It is our practice to place in front of the smallest trees only one hive; in front of those a trifle larger, two hives; those still larger, three hives, and, when they are of fair size, five, as in the Miller plan. Arranging the hives thus, gives each group of one, two, three, or five, as the case may be, an individuality of its own, thus affording the bees a better chance to distinguish their own group; but in every case the precaution must be observed of placing the hives on the *north* side of the tree. Where there are two and three in a group, one can have the entrances facing toward the south; or if there are only two in a group he can have one hive with its entrance pointing toward the south, and the other hive toward the east. In any case avoid having hives face the north and west. This is very important from the standpoint of wintering.

The following diagram shows how the hives on the three and two plan may be arranged, considering, of course, that the tree is just south of the hive, and one, two, three, or four feet from it.



In some apiaries in California we found double rows of hives, with a double alleyway between them, instead of being parallel, diverge from a common center, like the spokes of a wheel.

KEEPING GRASS DOWN AROUND THE HIVES.

Having decided on the location and plan of the apiary, the next question that would naturally arise is: Shall grass be allowed to grow and be kept down to an even height with a lawnmower or shall the sod be cut off entirely, and the hives be placed on a smooth plot of clay leveled off like a brickyard? In favor of this arrangement it may be said that queens can be easily found, and that, when the sod is once removed, all that is necessary is to go around the hives with a hoe or scraping-knife to shave off the weeds as fast as they come. If they are kept down thus, and the plot is sprinkled with a thin layer of sawdust raked over evenly, we have an almost ideal spot for bees. While ground floors of this kind are nice and pretty to look at, it means a great deal of labor and expense, because there is almost constant warfare against weeds. They will crowd their heads up through the sawdust; and at the present low prices at which honey sells, it may be doubted whether it pays. The great majority of beekeepers, however, after having leveled the plot, leaving the sod, consider it sufficient to keep the grass down with a lawn-mower. If it is mown once or twice a week, the yard not only looks pretty but practically there is no inconvenience resulting from the short grass. A lawn apiary is much prettier, and about as convenient in every way as one with a brickyard bottom.

KEEPING DOWN THE GRASS AT ENTRANCES OF THE HIVES.

It is not practicable to run a lawn-mower any closer than about two inches to a hive; and some sprinkle salt in front of the entrances and around the hives. This kills all vegetation up to a point where the lawn-mower can reach it.

But a good many apiarists do not even have the time to use a lawn-mower. As it would be a great task to keep the grass down in front of the hives where it would obstruct bees returning heavily laden from the fields, it is a very common practice to use a board little longer than the entrance, and a foot or 18 inches wide. This board should be cleated on the back, and attached to the hive so that the bees may have an easy runway clear up to the entrance. These boards may be planed and painted; but ordinarily we would recommend rough unplaned stuff — the cheaper the better. This gives the bees a good foothold, and at the same time saves some expense. See Entrances.

SHEEP FOR KEEPING DOWN GRASS IN THE APIARY.

One of our neighbors lets loose a few sheep in his apiary occasionally. It is well known that our woolly friends can gnaw the grass closer than any other stock. If a few of them be turned into an apiary for a day or two they will cut down all the vegetation close to the hives, not leaving a sprig of any sort. One would naturally suppose that the bees would sting the animals, with the possible result that a hive or two would be overturned; but in actual practice no trouble results. Once in a great while a sheep is stung; but instead of running and bellowing like a calf, or kicking and rearing like a horse, these animals quietly walk off to a bush and plunge their heads into it, and keep them there until all is quiet. A bee can not possibly hurt them except around the eyes and nose. But it is so seldom that they are attacked that one can not consider it cruelty to animals to use them as lawn-mowers. If one does not care to have them stung at all he can turn them into the apiary just at night, and before daylight drive them out again. But we have been in a yard where two or three sheep were allowed to graze the season through, and in all that time they were not stung more than once or twice, and yet the grass was kept down *automatically over every square foot of the apiary.*

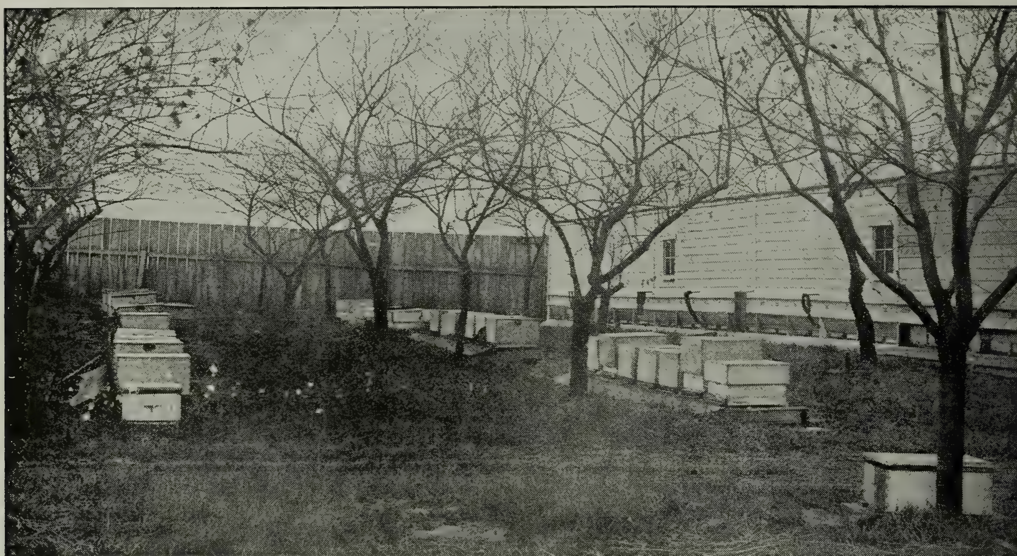
One would suppose the droppings might be somewhat offensive; but our neighbor assures us that this is not the case, as the manure very soon sun-dries, and it is of such a nature that it makes no trouble in the first place.*

THE HOUSE-APIARY.

This is a term that is used to designate a structure enclosing a whole apiary. The hives are usually arranged on shelves next to the outside walls and having direct communication with the outside.

As a general thing, an outdoor apiary is cheaper and more satisfactory than one in a building. For the house-apiary, the cap-

* I found several New York State yards where cows were pastured. Hives were far enough apart for cows to pass easily between.—A. C. M.



Outdoor colonies sheltered on the north by the house apiary, and on the west by a high board fence.

ital to put up the building must be furnished at the outset; and one that will take 50 colonies will cost much more than the same number of hives intended for outdoor use. But there are conditions under which the house-apiary may be and is used to advantage—in fact, affords the only method of keeping bees at all. Where land is valuable, such as in or near the city, or in localities occasionally visited by thieves, where bees, honey, and everything, so far as possible, must be kept under lock and key, it is a necessity. A small building, also, to accommodate 35 or 40 colonies, even when these conditions do not exist, may often be used very advantageously in connection with the regular apiary outdoors. When robbers are bad, or when the day is rainy, the work can continue right on, because the apiarist can leave the outdoor bees and resume operations inside, free from robbers in the one case, or protected from inclement weather in the other.

Until very recently house-apiaries have not been regarded with very much favor among practical beekeepers, principally on account of faulty construction, and because bee escapes, when house-apiaries began to come into use in certain quarters, were not known; but since the advent of these labor-saving devices, the troubles arising from bees leaving the hives, and crawling over the floor to die, or to be trampled on if not already dead, at the first visit of the apiarist, are done away with. These and other inconveniences have been almost wholly removed; and perhaps the only reason why the house-apiary is not more generally used is because of the expense, or first cost.

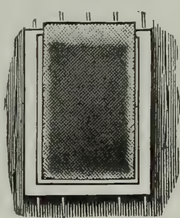
HOW TO CONSTRUCT A HOUSE APIARY.

The building may be oblong, square, octagonal, or round. The round or octagonal form will, perhaps, save steps during the operation of extracting; because, if the building is only 12 or 14 feet in diameter, the extractor may be put in the center of the room, and every hive will be equally distant, or practically so, and the combs may be transferred from hive to extractor, and *vice versa,* without taking more than one step; whereas, if the building is oblong some hives will be further from the seat of operations. The house-apiary building we are using is octagonal; but we found it a very expensive thing to make, and we were greatly annoyed by a leaky roof; and the only way to make it tight, with its many angles, was to cover it with tin. We would, therefore, construct a plain square building, say 12 feet across. For a roof we would adopt the plain gable, covering it with shingles. Where the winters are cold the building should *by all means be double-walled;* and sawdust or some sort of packing material should be poured in between the two walls. Unless it is warmly packed there will be bad wintering. Our own

W. C. Sorter's house apiary. The different colored rags are used to enable the bees to mark their own entrances more easily.

building is lined on the inside with tarred paper, and re-covered with manilla paper; but we are not sure that we would recommend it for any one else, because holes are constantly being punched through it. A better way would be to line it with wood—some cheap flooring would be good enough. If the joints are made tight, so that the packing-material will not leak, plain No. 2 barn-boards would answer. Through the roof, and extending through the center of the ceiling, we would have a ventilator-shaft, made of wood, about a foot square, and so arranged that it can be closed at will. During summer weather the smoker should be set directly beneath the shaft, and the ventilator opened for the escape of smoke. It should always be closed before leaving the building, because it is desirable to have the room perfectly dark, except at the small openings, where bee escapes are to be placed, as we shall soon explain.

As to doors and windows there should be only one window, and that opposite the door, so as to allow a draft to pass directly through, because the building at best becomes very sultry in hot summer weather. An ordinary tight-fitting door should be used, hinged in the usual way. To the outside of the door-frame there should be a wire-cloth screen door. At the top of the door the wire cloth should extend up as seen in the cut below; that is to say, it should be nailed on the outside, and should extend four or five inches beyond the bottom inside edge of the frame, leaving a



bee-space between the frame and cloth. This is to allow the bees that collect in the room during the time of working, as, for instance, during extracting time, to escape in accordance with the natural instinct that prompts them to crawl upward. The window should have wire cloth nailed on the outside in like manner, the same extending above the window-casing as in the figure.

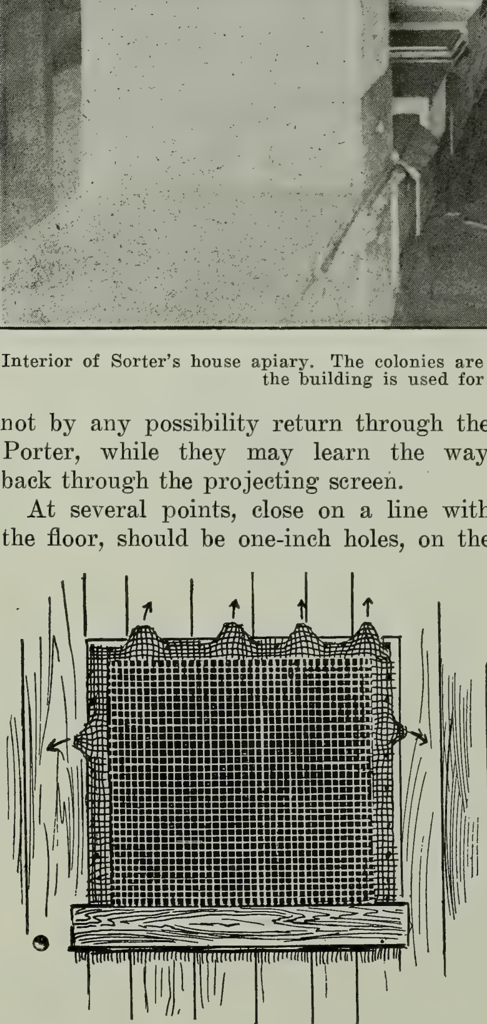
A better method is that shown in the larger cut, where the edges of the wire cloth are formed into bee escapes.

A better arrangement still, and the expense is but slight, is ordinary screen windows. At two of the upper corners attach Porter honey-house bee escapes as shown in the engraving in the next column. This will be more reliable, as the robbers can

Interior of Sorter's house apiary. The colonies are arranged along the south wall on the left. The rest of the building is used for empty supers, supplies, etc.

not by any possibility return through the Porter, while they may learn the way back through the projecting screen.

At several points, close on a line with the floor, should be one-inch holes, on the



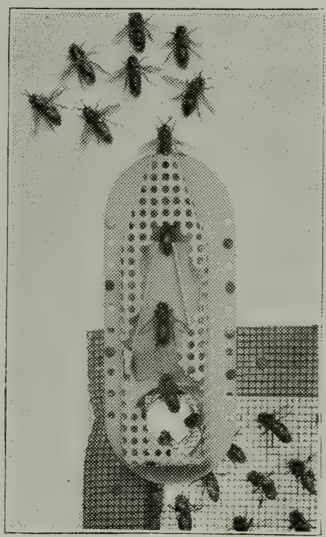
outside of which should be more Porter honey-house bee escapes. The purpose of the opening in these escapes is to let the bees that happen to be inside after working crawl out toward the light; and, once outside, they will enter their own hives, with the possible exception of a few young ones, and they will be accepted at any of the entrances.

A few years ago it was not deemed necessary to have anything but end boards to hold up the frames. These boards resting on the floor or shelf were secured against the side of the building. It remained then to close up the open side with a tight-fitting division board, and the top with a quilt. But this practice was found to be very objectionable; and those who manage house-apiaries now prefer to use ordinary outdoor hives instead, primarily because the bees can be more easily confined to the hives; and, secondarily, because the indoor and outdoor hives are one and the same, and interchangeable.

The entrances of the hives are so arranged that they communicate with openings through the side of the building; and then ordinary covers should be used to

confine the bees strictly within the hives. In lieu of a cover a thin 3/8 board, or something of that sort, may answer just as well; but so far as possible we would so construct the house-apiary that every thing outdoors may be moved inside, and *vice versa,* whenever requirements make it necessary. The dimensions of the house-apiary inside should be just large enough to take a row of your hives without wasting space.

For entrances to the hives from the outside there should be a two-inch round hole, lined with a tin tube that has first been painted, and then dusted on the inside with some fine sand while the paint is fresh, so as to make it rough enough for the bees to cling to the inside surface. These tin



Porter honey-house bee escape.

tubes should be inserted at the time of the construction of the building, and before the packing material has been poured in, and should be high enough for the bottom of the tube to come flush with the top of the bottom board. To connect this tin tube to the hive entrance is not difficult.

As the entrance through the house-apiary is 2 inches in diameter, it will be necessary to have a raised rim about 2 inches deep, the same width and length as the regular hive you are using. The side of the rim next to the building should be cut away for the 2-inch entrance, or else the whole side be left off entirely. This rim should be nailed down in position.

This rim will, of course, take the place of the regular bottom board. It is not absolutely necessary to make it two inches deep; it can be only one inch deep if preferred. The entrance then, instead of being at the ends of the frames, will be at the sides, or make a side entrance.

On account of convenience in handling frames, it is necessary to have the hive's side against the building.

To economize still further the space of the building, there should be another tier of hives about four feet above the floor; and these should be supported by shelving that reaches clear around the room. The same arrangement with regard to entrances may be employed as described for the bottom tier.

Now let us urge again. Do not get the idea that you can build hives cheaper, and have them a part of the building. The ordinary outdoor hives are in every way much more handy. And another thing, do not be satisfied to put just a mere quilt on top of the frames. It is essential that the bees be confined strictly to their own hives, otherwise they will be crawling from one hive to another, killing queens occasionally, getting on the floor, getting mashed, to say nothing of the inconvenience to the apiarist when he desires to do any work inside.

PUTTING CROSS COLONIES IN HOUSE APIARY.

We have always observed that the crossest bees are but little inclined to sting *inside* of a building. When they fly from the combs that you are handling, they find themselves inclosed; and this so disconcerts them that they immediately fly to the screen windows and escape. James Heddon said, "If you have a cross colony, put it in the house-apiary and see how tame it will become."

HOUSE-APIARIES FOR WINTERING.

As the building is double-walled, and is (or ought to be) packed, colonies will require less protection than outdoors. Indeed, about all that is necessary to put them into winter quarters will be to put on an extra comb-honey super, tuck in a chaff cushion, replace the cover, and then the bees are prepared. In very severe cold weather, a small fire, or heat from a large lamp in the room, may, perhaps, be used to advantage; but artificial heat in winter-

ing should be used sparingly and with care, for oftentimes it does more harm than good.

APIS DORSATA.—See BEES.

APIARY, OUT.—See OUT-APIARIES.

ARTIFICIAL FERTILIZATION.—After the reader has read the subjects of DRONES, QUEENS, and QUEEN-REARING, he will fully understand that the mating of the drone and queen in a state of nature takes place on the wing in the air, but it never occurs inside the hive. Nature has seemed to design, for the purpose of avoiding in-breeding, that the queen shall find her mate in the open air, where, according to the law of chance, she will in all probability meet some drone not directly related to her. Attempts have been made at various times to bring about fertilization within the hive or within some small tent connected with the hive entrance. But all such attempts have resulted in failure, because the drones and queens, as soon as they find they are confined in a small inclosure, will bump against the sides of the mosquito netting or wire cloth, vainly seeking to escape.

A good many years ago Mr. J. S. Davitt, of Aragon, Ga., put up a tent of mosquito netting, 30 feet tall and 30 feet in diameter. Hives of bees containing select drones were placed around the bottom edge of the tent, each hive having two entrances—one opening into the inclosure and the other into the outer air. The latter is covered with perforated zinc in order to compel the queen and drones, when seeking flight, to pass out of the other entrance into the enclosure. This inside entrance was kept closed for about a week; then on some favorable day, from 11 A. M. to 1.30 P. M., it was opened and the drones and the queens were allowed to go into the tent. Mr. Davitt reported that a very pretty school of drones would be found flying at the top, and that he was successful in mating many queens. It will be noticed that the worker bees, accustomed as they are to the outside entrance, which is always open, do not go in to the inside of the tent during the mating hours, so that the drones and queens are largely by themselves.

Unfortunately this general plan has been tried by one or two others, but without success. So far no one else has had the nerve to try it. One man reported having tried taking a drone of mating age and pressing him until the drone organs were distended. The spermatozoa were then injected into the body of a queen of mating age. He stated that, although the wings of that queen had been clipped when she was one day old, she began to lay and the eggs developed into worker brood. The experiment is worth trying, and the author suggests that some of our A B C scholars try it out and report results.

So far the only feasible plan for mating queens with select drones is to put perforated zinc over the entrances of all colonies not having choice drones, leaving only select drones to have the freedom of the air. If there are no other bees in the locality except those having screened entrances, the chances will be largely in favor of having the queens mated to the drones of the colony selected. A still better plan is to take the queen-mating nuclei to an island where there is a colony of select drones, or several of them. This island should be located at least five miles from the mainland. See QUEENS, QUEEN-REARING, and DRONES.

ARTIFICIAL HEAT.—As strong colonies early in the season are the ones that get the honey and furnish the early swarms as well, and are in fact the real source of profit to the beekeeper, it is not to be wondered at that much time and money have been spent in devising ways and means whereby all might be brought up to the desired strength in time for the first yield of clover honey. As market gardeners and others hasten early vegetables by artificial heat, or by taking advantage of the sun's rays by greenhouses, etc., it would seem that something of the kind might be done with bees; in fact, we have, by the aid of glass and the heat of a stove, succeeded in rearing young bees every month in the year, even while the weather was at zero, or lower, outside; but so far as we can learn, all artificial work of this kind has resulted in failure, so far as profit is concerned. The bees, it is true, learned to fly under the glass and come back to their hives; but for every bee that was raised in confinement, two or three were sure to die,

from one cause or another, and we at length decided that it was best to wait until summer weather, and then take full advantage of it. See POLLEN.

Later we made experiments with artificial heat while the bees were allowed to fly out at pleasure; and although it seemed at first to have just the desired effect, so far as hastening brood-rearing was concerned, the result was, in the end, just about as before; more bees were hatched, but the unseasonable activity, or something else, killed off twice as many as were reared, and the stocks that were let alone in the good old way came out ahead. Since then we have rather endeavored to check very early brood-rearing, and with better results.

A few experiments with artificial heat have apparently succeeded, and it may be that it will eventually be made a success; but our impression is, that we had much better turn our energies to something else, until we have warm settled weather. Packing the hives with chaff, sawdust, or any other warm, dry, porous material, so as to economize the natural heat of the cluster, seems to answer the purpose much better, and such treatment seems to have none of the objectionable features of working with artificial heat. The packing needs to be as close to the bees as possible; and to this end we would have all the combs removed except such as are needed to hold their stores. Bees thus prepared seem to escape the ill effects of frosty nights in the early part of the season, and we accomplish for brood-rearing exactly what was hoped for by the use of artificial heat.

For the benefit of those who may be inclined to experiment, we would state that we covered almost our entire apiary with manure, on the plan of a hot bed, one spring, and had the mortification of seeing almost all die of spring dwindling. Another time we kept the house-apiary warmed up to a summer temperature with a large oil lamp, for several weeks, just to have them beat those out of doors. The investment resulted in losing nearly all in the house-apiary with spring dwindling, while those outside stayed in their hives as honest bees should, until settled warm weather, and then did finely, just because we were "too busy to take care of them" (?) as we used to express it.

WINTERING BEES IN A WARM ROOM.

But a number have wintered single colonies of bees in the living room of a house where the temperature was kept between 65 and 72, night and day, with very good results. In the cases mentioned, the colonies were placed on a shelf next to a window, with the entrance communicating with the outside. All old and superannuated bees can thus escape at any time; and when the weather is suitable the bees can fly. We have had one colony in one of our offices that has been there for the last three years. It always wintered well, and sometimes we have been tempted to try the experiment on a larger scale; but the house-apiary experience above mentioned has caused us to hesitate somewhat.

ARTIFICIAL PASTURAGE. — Although there used to be quite a trade in seeds and plants to be cultivated for their honey alone, we can give little encouragement to those who expect to realize money by such investments. There is certainly a much greater need of taking care of the honey that is almost constantly wasting just for lack of bees to gather it. A field of buckwheat will perhaps occasionally yield enough honey to pay the expense of sowing, as it comes in at a time when the bees in many places would get little else; and if it does not pay in honey, it certainly will in grain. If one has the money, and can afford to run the risk of a failure, it is a fine thing to make some accurate experiments, and it may be that a farm of one or two hundred acres, judiciously stocked with honey-bearing plants, trees, and grains, would be a success financially. It has been much talked about, but none, so far as we know, have ever put the idea in practice. To beginners we would say: Plant and sow all you can that will be sure to pay aside from the honey crop, and then, if the latter is a success, you will be so much ahead; but beware of investing much in seeds that are for plants producing nothing of value except honey. Alsike and white Dutch clover, buckwheat, rape, alfalfa, and the like, it will do to invest in; but catnip, mignonette, Rocky Mountain bee plant, etc., we would at present handle rather sparingly.

The question, "How many acres of a good honey-bearing plant would be needed

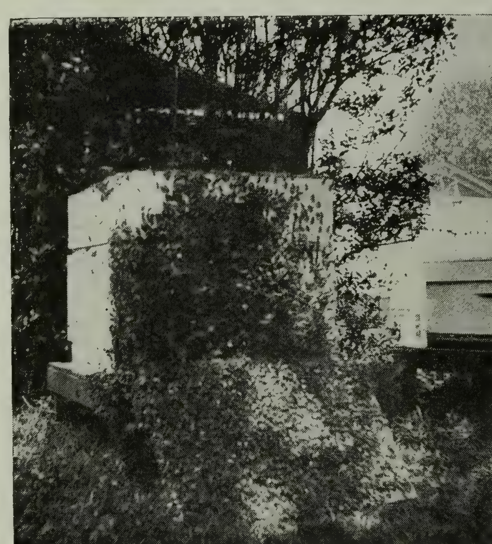
to keep 100 colonies busy?" has often been asked. If ten acres of buckwheat would answer in full bloom, we should need perhaps ten other similar fields sown with rape, mustard, catnip, etc., blossoming at as many different periods, to keep them going the entire warm season. It would seem 500 acres should do nicely, even if nothing were obtained from other sources, but at present we can only conjecture. A colony of bees will frequently pay for themselves in ten days during a good yield from natural pasturage; and if we could keep up this state of affairs during the whole of the summer months, it would be quite an item indeed. Alfalfa, sainfoin, sweet clover, buckwheat, rape, alsike clover, crimson and red clover, cow peas of the South, and some others, are the only cultivated plants that have given paying crops of honey, without question, so far as we have been informed. See Honey-plants in Index.

ARTIFICIAL SWARMING. — Before the reader takes up this subject he should first read carefully the article on Swarming in order that he may understand the conditions that bring about swarming in a natural way. He will then be in a better position to understand the principles involved in *artificial* swarming.

In the first place, the natural swarm, when it starts forth, is fully prepared to abandon its old home; and, no matter where it may be placed, its individual members have no thought of going back to the old stand. If, therefore, we would succeed with artificial swarming, we must practice some scheme that will remove the home-loving instincts to such an extent that the swarm that we have made up artificially will stay in the new location; and, not only that, will be in such a condition that it is, to all intents and purposes, a natural swarm. As it is somewhat difficult, however, to remove entirely the home-loving instinct, we are obliged to cater somewhat to it, and we therefore so far as possible hive our artificial swarm in the old location, so that, if the home-loving instinct has not been removed, or only in part, we shall still hold bees that would otherwise have been "homesick," and go back.

The swarm that goes out naturally, for a few days prior to its issuance begins to become logy. The bees show a disposition to hang out in front of the entrance, and there seems to be a letting-up in their activities. Whenever this condition begins to manifest itself, is the time to act. Instead of letting the colony go on and finally swarm unexpectedly at their convenience when we may be away, we anticipate their action and *force* them to swarm *at our convenience.* The plan in brief is as follows:

After the honey-flow has begun, and perhaps three or four days (not earlier) before the colony is expected to cast a swarm, the hive is moved to one side of the stand, and an empty one, just like it, is put in its place.* In this hive are placed frames having foundation starters or frames with full sheets—preferably the latter. But if neither is available, empty combs may be



R. J. Ruliffson's swarm shaken on the alighting-board of the new hive.

used. The bees of the parent colony are then shaken or brushed in front of the entrance of the *new* hive on the *old* stand. Some go so far as to brush *all* the bees out of the old hive; and this can be done if the weather is hot and nights warm; for young hatching brood will soon be out to take care of the young brood. The supers from the parent hive are next put on the new one. The parent colony is then moved

* Reports show that, if the colony is shaken or brushed from one week to ten days before a swarm would otherwise issue, no good will be accomplished and that the bees will be likely to swarm. The shaking should not take place *before the bees feel and show the desire to swarm.*

to a new location or left by the side of the new hive with its entrance facing in the same direction. In either case the entrance should be contracted.

If work is already partly begun in the super, the bees will continue work, and rush the honey above. In some cases it may be advisable to use perforated zinc between the super and brood-nest to keep the queen below.

The plan will meet favor, especially with those in localities where the season is short and the honey-flow rapid; and it will doubtless enable many usually getting no comb honey at all to secure a good crop.

The question may be asked, "What is done with the parent hive and all its brood?" If left beside the new colony, the brood, when hatched out, is shaken in front of the new hive, so that at the last drive all the bees that would have been hatched in the original colony are now given to the brushed swarm, after which the hive is moved away. In this respect a brushed or "shook" swarm, as some call it, will secure more comb honey than a natural swarm because it has the additional strength of the young bees. The queen from the old hive (if one has been raised or introduced) should, of course, be removed before the last drive, and given to some other colony.

While this plan of forcing the swarm ahead of time at the convenience of the apiarist generally gives satisfaction among beekeepers, some do not make it work; but so many have reported favorably through the bee journals that we are satisfied that, if details are carefully followed, it will prove successful with most people.

Another plan has been suggested that is somewhat similar to that already described; but instead of shaking all the bees at once the operation is performed at two different times. For example, a colony in an eight-frame hive has four combs of brood taken out of the center of the brood-nest and in their place is put an equal number of frames of full sheets of foundation. The combs removed are now shaken one by one in front of the entrance. Two or three days afterward, when work gets nicely started on the first frames of foundation the remaining old combs with their brood and honey are removed and a second set of frames are put in their place. The combs of brood are then shaken in front of the entrance as before. The beeless brood should, of course, be given to other colonies that can use them to advantage.

This involves the principle of the brushed or shaken swarm idea, and has the further advantage that the bees are not liable to swarm out as when they are shaken all at one drive on nothing but foundation.

DOOLITTLE MODIFIED SHOOK-SWARMING METHOD.

This is a plan that involves some of the principles of shook swarming; and in certain localities it can be employed to very good advantage. The method in brief is as follows: Sets of partly filled extracting-frames from weak colonies the year before, as will be explained later, are kept over winter in the honey-house, until the spring or early summer, when upper stories are filled with them, and placed on all strong colonies. The idea of this procedure is to make the colony below feel rich in stores so there will be no curtailment of brood-rearing. If any honey should come in from fruit-bloom or other sources before the main flow it is promptly carried upstairs without crowding the queen below.

A week or two prior to the expected honey-flow or swarming season this upper story is lifted off and the old colony moved to one side. On the old stand is placed another empty hive. The set of combs, all save one, that were originally in the upper story, containing more or less honey, are now put down in the empty hive on the old stand. One comb is left out in the center, and replaced by a frame partly filled with brood from another hive. On this hive, at the parent stand thus prepared, is placed a comb-honey super containing sections filled with full sheets of foundation, and having at the center ten or twelve other sections with partly drawn comb. On this super is placed another of sections with only full sheets of foundation. Last of all the cover is put on. The frames of brood put in the old hive removed to one side are now taken out and shaken in front of the entrance of this newly prepared hive at the old stand. The brood is then stacked up on the few weak colonies not run for comb honey. As the bees hatch, the combs are more or less filled with honey during the season, thus furnishing the sets of extract-

ing-frames to be used for the comb-honey colonies the next year. The queen in the comb-honey hive will have the one frame of brood partly filled where she can begin laying. The large amount of honey in the brood-nest the bees will begin carrying upstairs to the supers in order to give the queen more room in which to lay. Thus work is started in filling the sections before the honey-flow actually begins; and when honey does come in, the bees continue to store it above without any swarming. In the meantime the queen occupies every available cell in the lower part of the hive.

Mr. G. M. Doolittle, the author of this system, has tested it most thoroughly several seasons; and one year in particular, when the season was only fair, secured an average of 114½ pounds of comb honey per colony, *with no swarms* at any outyard.

While the first sections will contain a little old honey, yet if it be buckwheat or other good honey it does not impair the flavor, for there are many who like a little buckwheat flavor in comb honey; and such sections, Mr. Doolittle says, sell at the highest market price. For further particulars see Doolittle's book, "A Year's Work in an Out-apiary," put out by the publishers of this work.

The Hand bottom-board; the proof of the pudding is in the eating.

Thus far we have discussed methods for "shook" swarms. There are some who object to the inconvenience of shaking the bees off the comb in front of the hive, especially so as this shaking sometimes throws considerable new honey upon the alighting-board and upon the bees. It sometimes causes them to fly up and sting.

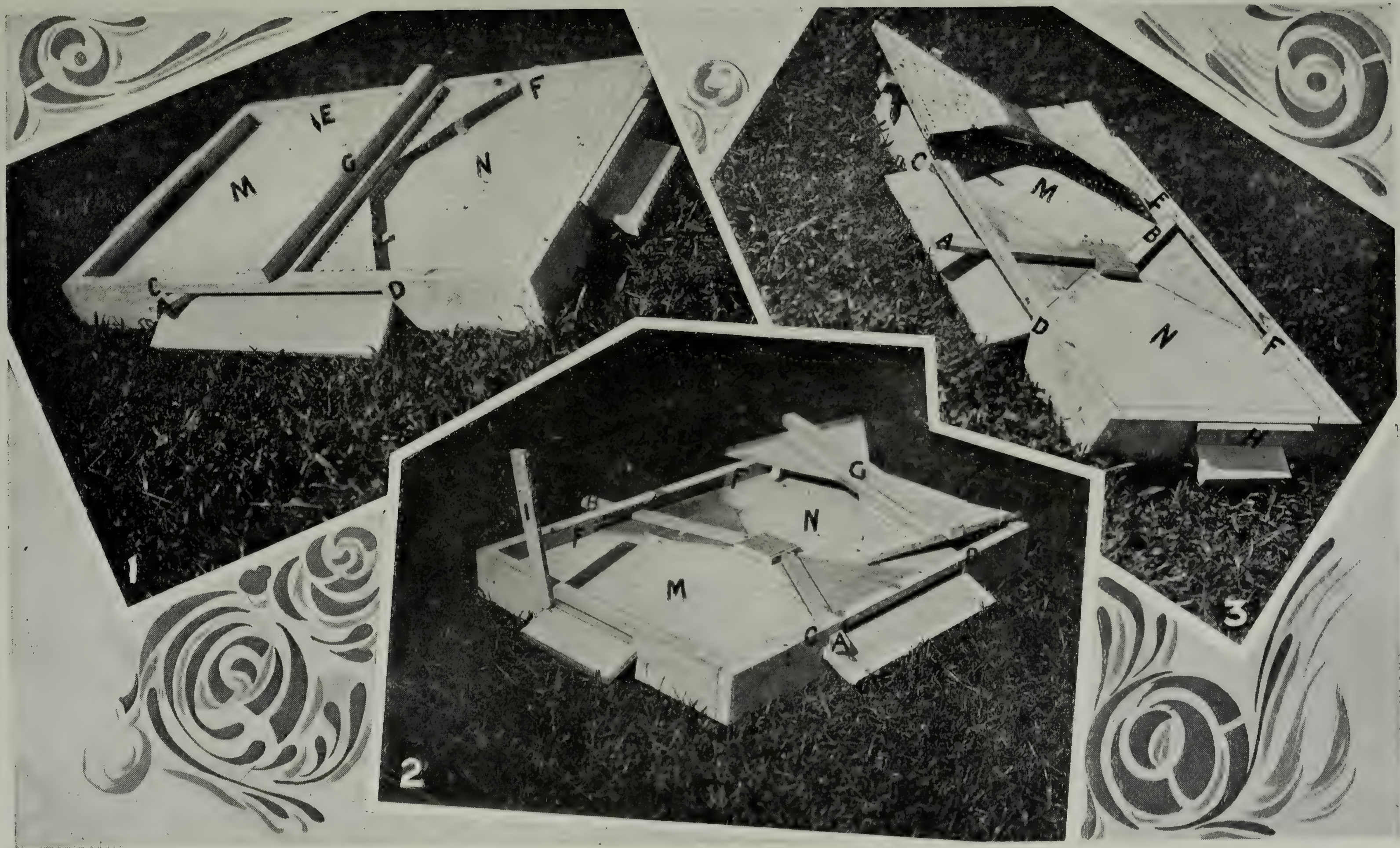
Mr. J. E. Hand, of Birmingham, Ohio, has invented a system that involves the principles of shaking, but avoids all the inconvenience. The scheme consists of a double-width bottom-board large enough to take two hives side by side. There is an entrance on all four sides of this double bottom that can be manipulated in such a way as to throw the working force preparing to swarm from one hive on one side of the board to the hive opposite. This is accomplished by the simple manipulation of switch levers or gates. Mr. Hand, in his book, "Beekeeping by Twentieth Century Methods," thus describes the manipulation:

HAND'S SYSTEM OF SWARM CONTROL

When the harvest is in full blast, and the top story is found to contain considerable honey, don't wait until it is more than one-fourth full, nor until the bees have made preparation to swarm, but nip the swarming impulse in the bud in the following manner: We will assume that our hives are all on the double-switch-board bottom. The stronger colony with its upper story that is to be manipulated we will call for convenience No. 1, and the hive into which the flying bees are to be switched, No. 2. Please remember this in all subsequent references in connection with this double bottom, to avoid confusion.

Begin operations for swarm control by placing the top story, bees and all, of No. 1 down upon the vacant side of the double-switch-board bottom, and exchange the central comb for a comb of brood and bees, including the queen from hive 1; put on a queen-excluder and a super of sections on No. 2, and close the hives. Next throw the front switch, thus closing the inner entrance to hive 1, and opening the one leading to hive 2, at one operation. This is done without changing the appearance or position of the outside entrance, which is always open full width.

The returning field bees, laden with nectar, will enter the new hive, or No. 2, without a moment's



The Hand switch-lever double-bottom and hive-stand to take two hives side by side. Note No. 1 shows the device ready for two hives. Nos. 2 and 3 show the switching mechanism dissected. A and B are the switch levers which, being moved from one side to the other, throw the working force of the bees from one side of the bottom-board to the other, or from one hive to the other. Crosss-rail C separates the two hives, and the sheet metal in the shape of a letter X covers up the two switch levers in such a way that the bees can not get from either hive to the other except as the lever is moved from one side to the other. I in Fig. 2 and H in Fig. 3 are the side entrances.

hesitation, and through their accustomed entrance. No time is lost to the bees in getting accustomed to new surroundings, which means a gain of several pounds of honey in favor of this system over other methods where the position of the entrance is changed or where bees are shaken or brushed, and otherwise roughly treated, throwing them into an abnormal condition.

We will now throw the switch on the back side to provide a new entrance to hive 1, which has been so smoothly robbed of its field bees, and which is now given a young laying queen or a virgin just hatched. The honey in the new brood-chamber, or No. 2, will go into the sections to make room for brood below. A strong point in the new system is, that the brood in No. 1 is held in reserve to reinforce the swarm in No. 2, one hive being a storehouse for honey and the other a nursery for reinforcements of young bees, both being connected and under perfect control.

As soon as there is a goodly force of young bees again flying from the rear entrance of hive 1 (which will be in eight to ten days) we again shift them over into hive 2 by throwing the switch of the rear or back entrance, again closing the inner entrance to hive 1 and opening that to hive 2. The returning field bees will scamper into hive 2 through their accustomed entrance as though nothing out of the ordinary had happened. Again, this is what we understand by perfect control of bees. Both of the switch-lever entrances to hive 1 being closed, we will provide a new one this time by opening the auxiliary entrance on the side. This will usually settle the swarming question during an ordinary honey-flow. However, in locations having a prolonged honey-flow the method should, perhaps, be modified by using full sheets of foundation in the new brood-chamber; or No. 2, if there is still an inclination on the part of the swarm to cast a swarm they should be shifted back into 1. This is quickly done by reversing both levers, front and rear, and opening the side entrance to 2, to provide for young bees not flying, and for brood hatching out. Next transfer the supers, bees and all, over to 1. Colony 1, having a young queen that has laid but few eggs, will not be likely to cast a swarm, especially since it has a double entrance, front and rear, and a side entrance, aided by a one-inch space under the frames, making about the strongest combination imaginable for the control of swarming. However, in very hot weather we usually block up one end of the cover half an inch and provide shade-boards for colonies that are exposed to the direct rays of the sun. These are the little things that help to make up the sum total of the perfect control of bees. It is superfluous to add that very few colonies in a normal condition will cast a swarm under the conditions above mentioned.

So far Mr. Hand feels that his plan of swarm control is a success. Whether it will continue to show up as well in the hands of others, remains to be proven. The illustrations are a fair sample of the hives in the yard manipulated on that plan. The taller of the pair of hives in each case is the one that has received a shift of flying bees and the supers from the shorter one. The latter in the meantime has been put into an impoverished condition to cause it to destroy its cells and hatch out its brood. When this hatched brood is of flying age it is shifted to the other hive. If, however, the tall hive is preparing to swarm, its force of fielders is shifted into the hive of the newly hatched brood. The two forces of bees are then ready to do business in the supers that have been again transferred over.

We tried what was known as the Sibbald method of swarm control at one of our outyards. This plan had the same basic principle, but was not as convenient to work. The Sibbald system involved the idea of having the colonies arranged in pairs, one very much stronger than the other. When the stronger colony began to show evidence of its intention to swarm, it was shifted over to the place occupied by the weaker one, and the weaker one placed on its stand. The supers on the strong colony were given to the weak one. Theoretically, all of the flying bees would go to the old stand; the cells that were built in the colony preparing to swarm would be destroyed because it would be robbed of all its flying bees. But the scheme worked only partially. Some

The Hand switch-lever bottom in use, showing auxiliary entrance in one side open.

strains of bees would go back to their old stand in spite of the change of position. Right here Mr. Hand makes a decided improvement in the fact that in the switch-lever bottom-board he makes this absolutely impossible. After the shift of the switch-lever the bees go back to precisely the same alighting-board that they did before, but they are *compelled* by the gate or valve arrangement, so to speak, to go into the other hive, whether they will or not. Here they find that there are no cells started, very little of brood, and, as they will not be likely to swarm without conditions being favorable to swarming in the way of swarming-cells and a congested brood-nest, they will go on storing in the supers.

A feature of the arrangement is that it allows the beekeeper to use his old hives and equipment, the only change necessary being the switch bottom-board, which has been patented.

So far we have discussed various methods of artificial swarming. Under the head of INCREASE we take up the question of various methods for increasing the number of our colonies by dividing or otherwise. The reader should understand that "artificial swarming" is one thing, and "increase by dividing" is entirely another. The former is used to prevent natural swarming, or rather put it at a time to suit our convenience and yet get a crop of honey. The latter does not contemplate the notion of securing honey, but rather an increase in the number of colonies.

ASTERS.—(*Aster,* the Greek word for star). Called also starworts and in England Christmas daisies from their late period of blooming. This is a genus of the Compositæ, the largest and most important plant family, to which also belong the goldenrods, sunflowers, thistles, and daisies. There are about 142 species of asters in North America, and about half that number in northeastern America. The species are very difficult to distinguish, as there are numerous varieties and hybrids. Asa Gray declares in one of his letters that the asters threatened to reduce him to blank despair. The so-called flower of an aster is in reality a cluster or composite of many small flowers surrounded by small green bracts. The marginal or ray flowers have strap-shaped corollas, which resemble petals, and are blue, purple, or white, but never yellow. The central or disc flowers are tubular and range in color from dark to golden yellow, changing in some species in the later stages of the flower to crimson purple, brown purple, or purple. They are more abundant in North America than in any other continent.

The asters are visited by many other insects than honeybees, such as bumblebees, wasps, butterflies, and flies. On the New England aster mentioned below there have been collected 46 different kinds of insects, and on the common *A. puniceus,* or red-stalk aster, 77 different visitors. Thus the honeybee has many competitors for the nectar, which is secreted at the base of the tubular flowers.

Aster.

Where asters and goldenrod abound largely, it may be best to defer feeding until these plants have ceased to yield honey, say the last of September.

In some localities, notably along the bottom lands and during some years, the asters may yield considerable honey, on the amber order, of good heavy body, but of a flavor that would not ordinarily be considered suitable for table use. It must go to the confectioner or to the baker. Commercially it is scarcely known on the market.

A very common variety is the *A. patens,* with bright bluish-purple flowers. These are low-growing, with wide-spreading branches, and branchlets terminating in a

solitary flower-head. They grow along the dry riversides in early August.

The New England aster, *Novae Angliae,* has stout hairy stems some eight feet high, with some large violet-purple or sometimes pinkish flower-heads. These are conspicuous in late summer.

Another species is a tall swamp variety with long showy pale-lavender ray-flowers.

One of the most common asters is *A. cordifolius.* As its name indicates, the leaves are heart-shaped; but it is not the only species of this numerous family, with leaves of that shape. It has many pale-blue or almost white flowers.

A beautiful specimen is the "seaside," a purple aster—*A. spectabilis.* This is a low-growing plant with large bright heads having the usual purple ray-flowers. It grows on sandy soil near the coast.

In Georgia several species of aster (the most common are *Aster adnatus, A. squarrosus*) grow all over the State, and in many places are the main reliance for late surplus and winter stores. The honey is medium in quality and color, and candies quickly if not sealed.

The main source of aster honey is from the varieties *A. tradescanti, A. multiflorus, A. demosus, A. vinincus,* and *A. paniculatus,* the *multiflorus* being the most common. All of these produce a mass of very small white-petaled flowers. The fields often look as if covered with snow so thickly covered is the ground with these plants. They grow from six inches to three feet high. The honey from them is water-white and highly aromatic. When newly gathered it has a rank odor, but this disappears after a time. When the weather is favorable, colonies will pack their combs with it; and where they have the combs filled from an earlier source they often put up a surplus. The sale for this honey is limited, as it is too aromatic to suit many palates.

In general we may say that the aster, like the goldenrod, is conspicuous during the fall of the year throughout almost all the United States; and, like the goldenrod, it might be called our national flower.

B

BALLING OF QUEENS. See Queens, Queen Rearing, and Introducing.

BANAT BEES.—See Bees.

BARRELS.—The regular size used for the storage and shipping of honey is anywhere from 31 to 32 gallons. Barrels of 45 to 50 gallons capacity, however, are a little too heavy; being very unwieldy they are liable to be broken or jammed by freight-handlers in shipping. As to the kind of barrel, second-hand alcohol or whisky barrels that can be obtained at the drugstores may be used, providing they are not charred on the inside. The ordinary alcohol-barrel is gummed or glazed on the inside with a preparation of glue that does not dissolve. As a general rule, whisky-barrels are charred, and therefore unsuitable. Before taking barrels of any kind it is very necessary to determine what the character of the lining is on the inside. Molasses or syrup barrels may be used, if they be thoroughly cleansed; but barrels that have a sour or musty smell should not be considered for a moment; for, even if cleaned, they might taint and ruin the honey.

After the barrel has been cleaned it should be put in a dry place, so that it will dry thoroughly, inside and out; and in this connection it is proper to remark that one should never use barrels, the wood of which has become soaked with water; for honey has the quality of absorbing moisture from the wood; that is to say, a wet barrel filled with honey will actually become dry. The staves shrink, and then, of course, the honey leaks out. If one does a large business in shipping honey in barrels he should buy new ones. The staves should be made of sound kiln-dried stuff; and nothing but iron hoops, not wooden ones, should be used. The barrels should be kept in a dry place, and then, before using, they should be well coopered and tested, as will be explained.

KEGS.

Wooden packages holding from 100 to 150 lbs. are used quite extensively in some parts of the East. They are usually made of cypress, and, when well made, make a very good package. The general directions that apply to barrels equally apply to kegs.

BARRELS THE FREQUENT CAUSE OF COMPLAINT.

It may be said that no slovenly, careless, or slipshod beekeeper should use barrels. He will be too careless to see that they are tight. He will put his honey into them, ship them, and in all probability the barrels will begin to leak *en route;* and he will receive a complaint from the consignee that "the honey arrived in bad condition," "half of it gone." There have been more ill feelings and hard words because of inexcusable carelessness or lack of proper knowledge concerning this matter of shipping honey in barrels than, perhaps, any other thing connected with the marketing of honey. If the directions we have given are carefully followed, and good barrels are selected, there will be little or no trouble.

Another frequent source of complaint arises from the fact that the barrels are filled too full. Honey, during the process of candying, will expand. If it is put into the barrel long before it is candied, the barrel should not be filled quite full. Just before shipping put in a little more and then ship. We have received several consignments of honey that had candied, in barrels. The barrels had been filled full; the honey candied, and burst the barrel.

HOW TO TEST BARRELS FOR LEAKS.

Barrels that are intended for the storage of honey should not be kept in a cellar but in a *dry place.* Before filling, the hoops should be driven down tight all around. To test for leakage, Mr. N. E. France, Platteville, Wis., a beekeeper of large experience, recommends the following plan:

Drive one of the bungs in, and then with the mouth* placed tightly over the other bunghole blow in until there is quite a pressure in the barrel. To do this, place the mouth over the hole, exhaust the lungs, draw in a fresh supply through the nose, exhaust the lungs again, and so on until you have forced in all the air possible. Place the side of the palm next to the mouth, then with a quick sliding motion move the mouth simultaneously with the palm, and close the opening. Now listen for air-leaks. If there are any, there will be a hissing in one or more places. Dip the free hand into some water, and push it along to where the air seems to be hissing out. This will prove beyond a doubt whether there is a leak at that point. If there is one, there will be a sputtering or bubbling. Note the place, and then hunt for other leaks. But all this time, of course, the palm of one hand should be held over the bung through which the air was forced. Wherever the air is found leaking through, drive the hoops down still further until the openings are closed. Then, again, force air into the barrel and try for leaks as before.

Do not, under any circumstances, test a barrel for leakage with water, as it soaks up the wood, and the latter would swell up and close the leak. After the honey is put into the barrel it would absorb the water, and the barrel would leak just at the time it could be least afforded—when it would be half way on its journey.

THE NEED OF PARAFFINING OR WAXING BARRELS.

We are well aware that some of our best honey-producers say it is not necessary to wax or paraffine barrels inside; but our experience shows that it is very important, not so much so for the purpose of closing up any possible leaks as to prevent the honey from soaking into the wood of the barrel or the wood itself from giving a taint to the honey. The average person has little idea of the amount of honey that can be soaked up inside of an unwaxed barrel, and be charged up to the shipper. After having tested the barrels for leaks by the air-pressure plan recommended, and made it tight, wax or paraffine the inside of the barrel; don't depend on the waxing to close up the leaks—*the barrel should be tight before.*

Paraffine, being a good deal cheaper than beeswax, and melting at a lower temperature, is, therefore, to be recommended. Melt up about 10 or 12 lbs., and when hot pour it through a large funnel into one bunghole of the barrel. Quickly drive in the bung, roll it around, twirl it on each head; then give it another spin so as to cover perfectly all around the chime. This operation will warm the air inside to such an extent that the liquid will be forced into every crevice. As soon as the inside is covered, loosen the bung with a hammer; and if the work is well done the bung will be thrown into the air with a loud report. Pour out the remaining liquid, warm it up again, and treat the other barrels in a like manner.

The operation as a whole takes but very little time; and if one has taken pains to prove the barrel tight by the air-pressure plan, the coating of paraffine on the inside will make it doubly secure. Second-hand barrels especially should be paraffined; and even new barrels should be so treated to prevent a great loss of honey that would necessarily soak into the wood. Steel barrels are not recommended.

BARRELS OR SQUARE CANS.

In California, Colorado, and other hot dry States, barrels and kegs should never be used. The ordinary 60-pound tin cans, described under EXTRACTED HONEY, are the only suitable shipping-packages. Indeed, they are the only package that nine-tenths of the beekeepers of this land can use safely. While they cost considerably more per pound, yet the honey is nearly always reported as going through in good order. Even if one has a hole punched in it, only 60 pounds of honey is lost; while in the case of a leak or break in a barrel, anywhere from five to eight times that amount is wasted. Through the entire West—and that is where the great bulk of the extracted honey in the United States is produced—the square tin can, two in a case, is used exclusively; and we would strongly urge the average beekeeper to use them in preference to barrels. While the tin package costs a little more per pound, it also brings a little more on the market;

* It would be a crime for a man with tuberculosis to do this. What is the matter with a tire pump fitted to a special bung?—A. C. M.

for the buyer can take as large or small a quantity as he needs. Where the purchaser hesitates to buy a whole barrel of honey for his own local trade, he will readily take one or more cans of 60 lbs. each.

REMOVING CANDIED HONEY FROM BARRELS.

Good thick honey will usually become solid at the approach of frosty weather, and perhaps the readiest means of getting it out of the barrel in such cases is to remove one of the heads and take it out with a scoop. When it is quite hard, you may at first think it difficult to force a scoop down into it; but if you press steadily, and keep moving the scoop slightly, you will soon get down its whole depth. If the barrel is kept for some time near the stove, or in a very warm room, the honey will become liquid enough to be drawn out through a large-sized honey-gate.

A more wholesale way of removing candied honey is to set the barrel or keg in a tub or wooden tank of water, the latter being kept hot by a small steam-pipe. In 24 or 36 hours the honey in the barrel will be melted, and can then be drawn out in the usual way.

BASSWOOD.—(*Tilia Americana L., Tilia heterophylla Vent., Tilia pubescens Ait.*, chiefly in the forest of eastern North America, and *Tilia Europaea L.*, under cultivation). Known also as linden, lime-tree, bee-tree, whitewood, and whistle-wood. Of the 11 described species 4 occur in North America.

Excepting, perhaps, alfalfa, sage, and white clover, basswood (often known as "linden") furnishes more honey than any other one plant or tree known in this country. It is true that it does not yield honey every season; but what plant or tree does? It occasionally gives us such an immense flood of honey that we can afford to wait a season or two, if need be, rather than depend on sources that yield more regularly, yet in much smaller amounts. If a beekeeper is content to wait, say ten or fifteen years for the realization of his hopes, or if he has an interest in providing for the beekeepers of a future generation, it will pay him to plant basswoods. A tree that was set out about ten years ago in one of our streets now furnishes a profusion of blossoms almost every year; and from the way the bees work on them we should judge it furnishes considerable honey. A hundred such trees in the vicinity of an apiary would be, without doubt, of great value. See ARTIFICIAL PASTURAGE. Our 4000 trees were planted in the spring of 1872, and in 1877 many of them were bearing fair loads of blossoms. We made some experiments with basswood seeds, but they proved mostly failures, as have nearly all similar ones we have heard from. By far the better and cheaper way is to get small trees from the forest. They can be bought for about a cent each. These can be obtained in almost any quantity, from any piece of woodland from which all stock has been excluded. Cattle feed upon the young basswoods with great avidity, and pasturing woodlands is eventually going to cut short the young growth of these trees from our forests, as well as of many others that are valuable. We planted trees all the way from one to ten feet in height. The larger ones have, as a general rule, done best.

The cut will enable any one to distinguish at once the basswood when seen. Clusters of little balls with their peculiar leaf attached to the "seed-stems" are to be seen hanging from the branches the greater part of the summer; and the appearance, both before and after blossoming, is pretty much the same. The blossoms are small, of a light-yellow color, and rather pretty; the nectar is deposited on the inner side of the thick fleshy petals. When profuse it will sparkle like dewdrops if a cluster of blossoms is held up to the sunlight.

Climatic influences have their effect upon basswood. Among the hills of York State the leaves assume mammoth proportions. We measured one that was 14 inches long. While this leaf was among the largest, yet the leaves were, on the average, about twice the size of those in our locality. In Illinois we noticed that the basswoods seemed to be less thrifty than in Ohio. The leaves seemed to be smaller, and the bark of the trees of a little different appearance. The next engraving represents quite accurately the typical forms, however.

The European basswood, or linden (fully as good a honey-producer as the American species) is famous as an avenue tree, as it furnishes a fine shade and is unaffect-

Basswood.

ed by the grime and dirt of the cities. The famous street of Berlin, Unter-den-Linden, is shaded by this species. It is known in England as the "lime" tree, and is there a great favorite for street planting. The famous "Lime-tree Walk" of Cambridge University is well known. This tree takes precedence over all others for street planting in the northern United States. It blooms earlier than its American sister.

It is rather to be regretted that basswood is not more plentiful, being one of the main stays, where it grows, of the honey-producer, and one of the most valuable woods in manufacture. It will hardly do for outside exposure to the weather; but

it is admirably adapted for packing-boxes, and is used in *immense* quantities for the manufacture of furniture, forming the bottoms and sides of drawers, the backs of bureaus, dressing-cases, etc., and it is also employed extensively in the manufacture of paper.

It has often been charged that we are cutting off our own noses by using it for one-piece sections—that we are "killing the goose that lays the golden egg." Well, it is true that apiarian-supply makers use quite a little; but still, the amount *they* use is very insignificant in comparison with that employed by furniture-manufacturers, various packing-box concerns, and wood-pulp and paper makers.

After all, there is one redeeming feature, the basswood is a very rapid grower. We thought at one time that we had used nearly all the basswood in this section, to say nothing of the enormous quantities shipped in from Michigan and other States; yet somehow the farmers still bring in beautiful nice white basswood lumber; but where they get it in our vicinity is a puzzle. At least some of this timber is from a second growth of trees that sprouted from the stumps of old trees—said trees having been cut for us ten years ago. *If* basswood will replace itself in ten or even twenty years, so that it can be used again for lumber, there is yet hope that it will continue to bless the beekeeper.

Over against this is the stubborn fact that our basswoods are disappearing, and rapidly, too, over all the country. During 1899, when there was such a great advance in pine lumber, basswood was used very largely for house-building, with the consequence that millions of feet were used up.

Basswood, and perhaps most other forest trees, require shade, especially when young. Much to our surprise, some that were planted directly under large white-oak trees have done better than any of the rest. Who has not noticed exceedingly thrifty basswoods growing in the midst of a clump of briers and bushes of all sorts? We would plant the trees not more than 12 feet apart.

The best yield of honey we ever had from a single hive, in one day, was from basswood bloom, the amount being 43 lbs. in three days. The best we ever recorded from clover was 10 lbs. in one day. Honey from the basswood has a strong aromatic or mint flavor, and we can tell when the blossoms are out by the perfume about the hives. The taste of the honey also indicates to the apiarist the very day the bees commence to work on it. The honey, if extracted before it is sealed over, when it is coming in rapidly, has the distinctive flavor so strong as to be disagreeable to some persons. A lady likens it to the smell and taste of turpentine or camphor, and very much dislikes it when just gathered; but when sealed over and fully ripened in the hive, she thinks it delicious, as does almost every person.

A pure basswood extracted honey, on account of its strong flavor, should be blended with some honey of milder flavor, like mountain sage, for example.

BEE BEHAVIOR.—Behavior is a term used to describe the activities of animal life whether induced by external or internal stimuli. Under this head will be described some of the various life activities of the bees, particularly those which have more or less to do with the practices of bee culture.

THE LARVAL BEE.

On the hatching of the egg the tiny larva wriggles and twitches much as does a caterpillar when poked with a straw. Almost at once it is supplied with food by a "nurse" bee. This part of the life of a larva has not received sufficient study to warrant any definite statements as to the frequency of the feeding, the amount supplied, its possible varying quality, etc. It must suffice now to say that the periods of feeding seem to be irregular and the amount of food received by different larvæ varies largely.

When the larva has completed its feeding period and has stretched out to its full length in the cell, the bees proceed to seal the cell. There are some exceptions to this when the larvæ are left unsealed, though usually the cell walls are slightly extended and the opening contracted. Beekeepers speak of this as "bareheaded brood" and it often causes the novice much concern. See Bees. The condition has been ascribed to excessive heat; but as it occurs at other times than during the hot weather, and as some colonies seldom or never have brood in such condition while others almost always do, it is reasonable to look upon it as

a congenital trait. In some cases uncovered brood is due to the work of the wax-moth.

After a brief rest the larva begins spinning its cocoon. Slowly the head turns from side to side and back and forth, gradually reaching the middle of the cell; and slowly doubling on itself, the larva extends its work to the base and lies at full length reversed in the cell. Before its labors cease, however, it usually resumes the former position of its head toward the outer end.

In the case of the queen larva, the spinning begins and proceeds in the same way, but when she is reversed in the cell she reaches as far up as she can, but that is not to the base; and as she can not climb there is no silken web on that part of the cell.

When spinning has ceased, the larva turns on its back and lies still. The changes which follow take place so slowly that only after considerable intervals are the results noticeable. When the metamorphosis is virtually complete (see DEVELOPMENT OF BEES), there is seen in place of the larva a bluish-white bee lying motionless on its back.

The only appendages seemingly missing are the wings. Careful examination will reveal each pair folded up in a little case (pellicle) which lies against the side of the thorax between first and second pair of legs.

The first sign of coloring is seen on the ends of the antennæ, then on the eyes and feet; and gradually it extends over the whole body. As the time approaches for the bee to emerge from the cell slight tremors are to be seen in the feet and legs, or an antenna moves. About the beginning of the last day the encased wings begin to quiver and move. Slowly they turn until they lie under the bee and at once they unfold. As soon as this occurs, the bee turns over and begins to cut its way out.

THE YOUNG BEE.

Almost as soon as out, it begins to move over the surface of the combs; and when it comes to a cell of honey it enters and eats. Just when it begins to eat pollen, is undetermined. After eating, the young bee commences to comb itself and this procedure continues more or less steadily for a day or more. At this tender age the insect's vision seems to be very imperfect. Also, it is unable to fly; and if tossed into the air makes no attempt to use its wings. This function appears only at a later age. Drones, queens, and workers all spend the early hours of their life in much the same way, except that queens seem to be able to fly sooner than workers. Probably queens most precocious in this way have been held in the cells longer than normally and have matured in there.

The color of the young bee deepens with age. When they first emerge they are much lighter in color than a day or so later. This difference is more noticeable with queens than with workers or drones.

HOME LABOR OF BEES.

The first duty of the worker is the feeding of the larvæ, and then a little at a time it extends to pollen-packing, propolizing, comb-cleaning, and repairing, honey-ripening, and comb-building.

THE FIRST POLLEN OF THE SEASON.

When a bee comes in from the field with a load of pollen, she is often surrounded by other bees, all trying to get a bite of the coveted food. This is especially noticeable in the spring when fresh pollen first appears. It is amusing to watch a pollen-laden bee side step, whirl, shake, and go through all sorts of actions to save her load. It is no unusual thing in the spring for such bees to be completely stripped of their loads before they can get near a comb.

HOW THE BEE UNLOADS HER POLLEN.

The pollen-laden bee seems decidedly fussy as to where she puts her load, once she gets up on to the combs. While one bee will inspect and pass many cells, the next bee so loaded may use the very cell the earlier bee refused. When a cell is decided upon, the bee backs partly into it; and with movements quicker than the eye can follow, she kicks off the pollen pellets. She seldom turns about to see if they are there, but goes off as if she had never had anything to do with it.

The pollen-packing is interesting, and apparently is developed from an attempt to eat it. When a field bee has deposited a load in a cell, a house bee inspects it and begins to nibble at it with more or less persistency. As she nibbles, the pellets are pushed and rolled along to the base of the cells and there the bee either continues to eat from them, or with the closed mandibles

pushes, kneads, and spreads the pollen on the base of the cell. While doing this, the little worker acts like a pig rooting.

PROPOLIS: HOW GATHERED AND USED.

Propolis is brought in on the pollen-baskets. When it is gathered fresh from the buds, it looks like a glistening bead in the pollen-baskets; but when it is gathered from old frames, hives, etc., the pellets are more irregular. Propolis is always packed while the bee is standing, while pollen which is packed and carried in the same baskets is adjusted while the bee is flying. This difference in the way of using the same limbs for different materials is very interesting.

Propolis is taken from the legs of the field bees and stuck into all sorts of places and is moved and reworked as suits the vagaries of the bees. Much of the propolis is spread with the tongue. Whether or not the bee varnishes the inside of brood-cells with propolis is unknown. Certainly they spend much time polishing the inside of such cells, going over and over the surface with their tongues; and when they have finished, the cell walls shine as if varnished. This is not done to new combs used for honey only; but let such be once used for brood, then it gets its polishing before being used for anything else.

Comb repairing and building seems to be a haphazard job, and the work of one bee is often at once undone by another. Propolis is used in the construction of new comb, sometimes as much as one-half to three-quarters of an ounce being added to a pound of wax. It adds to the strength of the comb and makes its fastening to the wood more secure.

HOW BEES DEPOSIT THEIR LOADS OF NECTAR.

The honey-laden bee on return from the field is not at all in a hurry to get rid of her load, and it is not at all unusual for her to keep her load for half an hour or more before depositing it. She may walk aimlessly about or settle quietly down somewhere and seemingly forget the world, or she may, after an extended journey over the combs, select a cell for her load. She enters the cell with her back down and feet up. If the cell has no honey in it, she goes in until her mandibles touch the upper and rearmost angle. The mouth and mandibles are opened and a drop of nectar appears, welling up until it touches the cell wall. Slowly the bee turns her head from side to side, spreading the nectar against the upper part of the cell. All this time the mandibles are kept in motion; and as the nectar covers their gland openings, it is possible that the secretions of those glands is being added to the nectar.

When the bee is adding her load to honey already in a cell, the proceeding is the same, except that the mouth parts are submerged in the honey already there. The mandibles are kept in motion as before. The tongue in neither case takes any part in the proceeding, but is kept folded up behind the head.

THE RESTING PERIODS OF BEES.

When rid of her load, the worker may at once return to the field, but usually she loiters about the hive for anywhere from a few minutes to half a day. So commonly do such bees crawl into a cell and go to sleep for a half-hour or so that it is reasonable to assume that such is the customary proceeding. By sleeping is meant as nearly a complete suspension of movement as possible. The customary pulsation of the abdomen nearly, if not quite, ceases, or is suspended for minutes at a time, and the occasional pulsation is very slow.

When the nap is over, the bee backs out, combs off her head just as if "scratching for a thought," and starts off in more or less of a hurry.

All the bees of a colony do a lot of this sleeping, and drones and queen are no exception; but in the case of the latter two, the sleeping is not usually done in cells.

When bees are getting stolen sweets, a very different condition arises, and a feverish excitement is noticeable in the returning workers, and it is not long before the whole colony is in a more or less disturbed state. Sleeping then is not in evidence. Why a load or several loads of *honey* should cause so marked a difference from several loads of *nectar* is unknown, and until we know more about the bee it is idle to speculate.

HOW BEES RIPEN HONEY.

Honey-ripening is a slow but interesting process. After the day's work is about over, almost the whole colony spreads out over all available surface, and nearly every bee has her sac full of honey. All the bees hang vertically with head up and all

seem to prefer not to be crowded too closely by the other bees. Then each bee opens her mandibles and mouth and forces up a drop of nectar. This drop fills the mouth and extends up over the upper lip and fills the space between the mandibles, covering the openings of the glands connected therewith. The tongue meantime is kept folded behind the head. Next the bee begins a chewing motion with the lower "jaw" and this causes the drop to pulsate. The mandibles are held still. They are not moved as in depositing nectar.

For about ten minutes this operation is continued; then the drop is swallowed, and after a few moments' pause another drop appears and the process is renewed. This is continued by the colony until about 11 P. M., or sometimes later, and then work stops and all hands go to sleep.

While the work is in process, the heavy hum so pleasant to the ears of beekeepers is continuous; but after the work ceases, the hive becomes almost silent. This varies with the amount of honey gathered during the day. Sometimes the humming lasts almost all night and sometimes it ceases early in the evening.

COMB-BUILDING AND ITS RELATION TO THE RIPENING OF HONEY.

Comb-building is rapid when most of the bees are ripening nectar. If the flow is good and many bees have to retain their loads for awhile, as with a recently hived swarm, wax secretion is rapid. Or if the flow is heavy and nearly all have to work at the ripening process, wax secretion is forced. The bees can not help producing it then. Its production seems to be closely connected with the conversion of nectar into honey. If this view is correct, it affords an explanation of the failure to obtain satisfactory results in feeding back ripe honey to have sections completed. Honey extracted "raw" or "green" and fed to comb-building colonies gives much better results.

VARIATION IN COMB-BUILDING.

No satisfactory explanation has been found to account for the construction of the two sizes of cells. Several theories have been advanced, but so far are only interesting.

Great variation in comb work is found between bees of different strains or of different colonies closely related. Some colonies build comb of wonderful smoothness and uniformity, and others never produce good combs. One will rarely use a brace or a burr, while another sticks them everywhere. By selection the beekeeper can weed out the stock with undesirable traits and perpetuate the others.

The difference in capping is well recognized, and selection is as effective in this case as in the former. The difference between colonies in building out to frame or section sides and down to bottom bars or of rounding off the edges has often been remarked. It may be stated in a general way that the bees which build clear to the wood usually leave the outer cells unsealed, while those bees which round off the edges of the combs seal all cells. (This was first defined by Mr. Allen Latham.) Of course, there are all gradations, but fundamentally the law holds good.

THE ARRANGEMENT OF BROOD, POLLEN, AND HONEY.

The arrangement of brood, pollen, and honey, the first in the center, then the others in order about it, is interesting, and with rare exceptions is always the arrangement. As the brood increases in the spring, we may say the pollen is forced outward and the honey forced beyond that. In the closing of the season the process is reversed, and under what we may be permitted to call natural conditions, as in a tree, box, or undisturbed frame hive, the brood is slowly worked downward and forward, so that at the end of the season the cluster is down by the entrance with the stores at each side of, above, and behind it. This is not always the location of the cluster in our frame hives; but if man has not meddled after mid-summer, it will generally be found to be so.

THE QUEEN.

This individual is unquestionably the most interesting member of the bee community, and more talked of and written about than any other, and perhaps more misunderstood. From earliest infancy she is subject to more vagaries than any of the other bees.

The presence or absence of the functional odor may have something to do with the introduction of alien queens, or it may be wholly their behavior.

After handling a laying queen, bees from any hive will run over one's hand, apparently eagerly seeking the queen, and the behavior of all workers is the same whether they are from the queen's hive or from another.

There is much difference in the temperament of queen; some are very timid, and will run on the slightest disturbance; and if handled or anointed with any foreign substance, seem to become really frantic, and such queens are very apt to be balled or killed by the bees. Other queens will passively submit to all sorts of treatment; and, as soon as let alone, will quietly resume their duties.

Virgin queens are almost always nervous or timid, and if put into a strange colony, large or small, very often, or perhaps it would be more accurate to say generally, run out and fly away, by no means always returning.

Before mating, a queen hunts up her own food from the combs; but after she begins to lay she turns to the workers for virtually all her food. Once in a great while she will dip her tongue into a cell of honey, but not often. As she passes about her duties, she from time to time crosses antennæ with workers. Finally one is found with a supply of food, the worker's mouth opens and the queen inserts her tongue and begins to eat. The worker's tongue is kept folded behind the head. It is quite common to see several other workers extend their tongues and try to get a taste of the food, and sometimes one will succeed in putting her tongue in with the queen's. It is not at all unusual to see two workers getting food thus from another worker, and the drones obtain their food in the same way.

Bees never offer food to the queen; she has to go after it. By the movement of her tongue one can see when she is seeking food. Caged fertile queens may get food from passing bees, but it is largely a matter of chance. Caged virgins seldom get any from workers outside. An extended tongue is always seeking, never offering.

Egg production is influenced by several factors. Queens differ in fecundity, and egg development is dependent on food. The food supply comes chiefly from the younger bees; and if they are not numerous the queen can not produce eggs in abundance. If honey and pollen are scarce or temperature is low, food is not prepared freely.

If the queen is young and vigorous and the colony small, she may deposit several eggs in each cell. If comb surface is insufficient and bees abundant, she will use cells of any shape, deep, shallow, or crooked, and will put in each one an egg which will produce a worker. Under some conditions a normal queen will put into worker cells eggs which will produce drones. She may be laying in shallow drone comb; and, coming to a queen-cell cup, will put into it an egg which will produce a female.

So many are the vagaries of a queen that only by observation and experience can most of them be learned. And the seasoned veteran not infrequently runs across some new peculiarity.

After an egg is put in a cell a worker is pretty sure to pop in and inspect it, and it has been supposed that possibly they did something to it. Inspection of thousands of bees occupied in examining eggs has failed to find a single one that touches an egg in any way. Bees often take their nap in cells containing eggs or larvæ.

During a heavy flow of nectar, the bees often deposit it in cells containing eggs sometimes filling the cells half full. Such nectar is removed within a few hours and the eggs hatch as usual.

DRONES.

Drones have many interesting habits, and are well worth closer study than they have yet received. They are much slower to mature after emergence from cells than the workers. They are very fond of warmth, and may often in cool weather be found massed shoulder to shoulder on outlying sealed brood.

It seems to take a lot of preparation on the drone's part before he can take wing. Drones pay no attention to a virgin queen among them in the hive, no matter what her age.

SWARMING.

Swarming apparently starts with a bee here and there. Such a bee suddenly begins to run a few steps one way, then a few another, then spins around and finally appears to work itself into a veritable frenzy. Other bees take it up and soon a rush is made, and is quite as apt to be from as toward the entrance. As soon, however,

as part of the flood begins to emerge from the entrance the tide turns that way.

VISION.

Bees' sense of sight is seemingly imperfect.* Moving objects attract their attention more than still ones. They apparently have difficulty in gauging their distance from dark or black objects. Experiments within a white-walled enclosure showed that they could avoid white or light objects, but would bump into a black one. If the bump did not cause the bee to sting, she would fly off and then hover carefully towards the black object. A black spot about an inch in diameter affixed to the white wall they would plunge at as if expecting to find an entrance to some cavity.

Some experiments with colors lead to the belief that lightness or darkness is of more importance than the color. See COMPOUND EYES.

BEE-BREAD.—A term in common use, applied to pollen when stored in the combs. In olden times, when bees were killed with sulphur to get at the honey, more or less pollen was usually found mixed with the honey; it has something of a "bready" taste, and hence, probably, came its name. Since the advent of the extractor and section boxes, it is very rare to find pollen in the honey designed for table use. See POLLEN.

BEE-DRESS.—See VEILS.

BEE ESCAPES.—See COMB HONEY, also EXTRACTING.

BEE-HUNTING.—We have given the warning so often, against leaving sweets of any kind about the apiary, and about being careful not to let the bees get to robbing each other, that it may seem a little queer to be directed how best to encourage and develop this very robbing propensity in these little friends of ours.

The only season in which we can trap bees is when they will rob briskly at home; for while honey is to found in the flowers in plenty, they will hardly deign to notice our bait of even honey in the comb. Before starting out, it will be policy to inform yourself of all bees kept in the vicinity, for you might otherwise waste much time in following lines that lead into the hives of your neighbors. You should be at least a mile from any one who has a hive of bees when you commence operations, and it were safer to be two miles. We do not mean by this to say that there are no bee-trees near large apiaries, for a number have been found within half a mile of our own, and an experienced hand would have but little trouble in finding more, in all probability; but those who are just learning would, very likely, be much perplexed and bothered by domesticated bees mixing with the wild ones.

Perhaps the readiest means of getting a line started is to catch bees that will be found on the flowers, especially in the early part of the day. Get them to take a sip of the honey you have brought for that purpose, and they will, true to their instinctive love of gain, speed homeward with their load, soon to return for another. To find the tree, you have only to watch and see where they go. Very simple, is it not? It certainly is on paper, but usually involves much hard work when carried out in practice. You can get along with very simple implements; but if your time is valuable, it may pay to go out fully equipped. For instance, a small glass tumbler will answer to catch bees with; and after you have caught one, you can set the glass over a piece of honey-comb. Now cover it with your handkerchief to stop its buzzing against the glass, and it will soon discover the honey and load up. Keep your eye on it; and as soon as it is really at work on the honey gently raise the glass and creep away, where you may get a good view of the proceedings. As soon as it takes wing it will circle about the honey, as a young bee does in front of the hive, that it may know where to return; for a whole "chunk" of honey, during the dry autumn days, is quite a little gold-mine in its estimation. There may be a thousand or more hungry mouths to feed, away in the forest at its leafy home, for aught we know.

If you are quick enough to keep track of the bee's eccentric circles and oscillations, you will see that these circles become larger and larger, and that each time the bee comes round it sways to one side; that is, instead of making the honey the center

* "Imperfect" is hardly the right word. The eyes are built on a plan wholly unlike ours, and therefore it must be assumed that the "mental picture" is different.

of its circles, it makes it almost on one edge, so that the last few times the bee comes round it simply comes back after it has started home, and throws a loop, as it were, about the honey to make sure of it for the last time. Now you can be pretty sure which way its home lies almost the very first circuit it makes, for it has its home in mind all the time, and bears more and more toward it.

If you can keep your eye on it until it finally takes the "bee-line" for home, you do pretty well, for a new hand can seldom do this. After the bee is out of sight, you have only to wait until it comes back, which it will surely do, if honey is scarce. Of course, if its home is near by it will get back soon; and to determine how far it is by the length of time the bee is gone, brings in another very important point. The honey that bees get from flowers is very thin; in fact, it is nearer sweetened water than honey, and if you wish a bee to load up and fly at about a natural "gait," you should give it honey diluted with water to about this consistency. Unless you do, it will not only take a great deal more time in loading up, but the thick honey is so much heavier the bee will very likely stagger under the load, and make a very *crooked* bee-line of its homeward path. Besides it will take much more time to unload. Sometimes, after circling about quite a time, the bee will stop to take breath before going home, which is apt to mislead the hunter unless he is experienced; all this is avoided by filling your honey-comb with honey and water, instead of the honey alone.

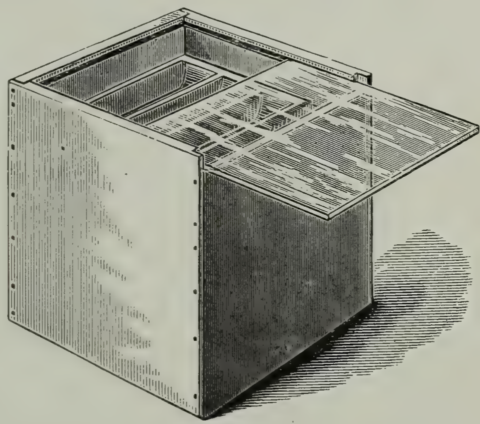
Now, it takes quite a little time to get a bee caught and started at work; and that we may get busy, we will have several bees started at the same time. To do this expeditiously, we will use a bee-hunting box made as in the following cut.

BOX FOR BEE-HUNTING.

This is simply a light box about $4\frac{1}{4}$ inches square; the bottom is left open, and the top closed with a sheet of glass that slides easily in saw-cuts made near the upper edge. About a half-inch below the glass is a small feeder quite similar to the one figured in FEEDING AND FEEDERS.

HOW TO USE THE HUNTING-BOX.

Take with your box about a pint of diluted honey in a bottle. If you fill the bottle half full of thick honey, and then fill it up with warm water, you will have it about right. In the fall of the year you will be more likely to find bees on the flowers in the early part of the day. When you get on the ground, near some forest, where you suspect the presence of wild bees, pour a little of your honey into the feeder, and cautiously set the box over the first bee you find upon the flowers. As soon as the box is well over the flower, close the bottom with your hand, and the bee will buzz up against the glass. Catch as many as you wish, in the same way, and they will soon be sipping the honey. Before any have



filled themselves, ready to fly, place your box on some elevated point, such as the top of a stump in an open space in the field, and draw back the glass slide. Stoop down now, and be ready to keep your eye on one bee whichever way it may turn. If you keep your head low, you will be more likely to have the sky as a background. If you fail in following one, you must try the next; and as soon as you get a sure line on a bee as it bears finally for home, be sure to mark it by some object that you can remember. If you are curious to know how long they are gone, you can, with some white paint in a little vial, and a pencil-brush, mark one of them on the back.* This is quite a help where you

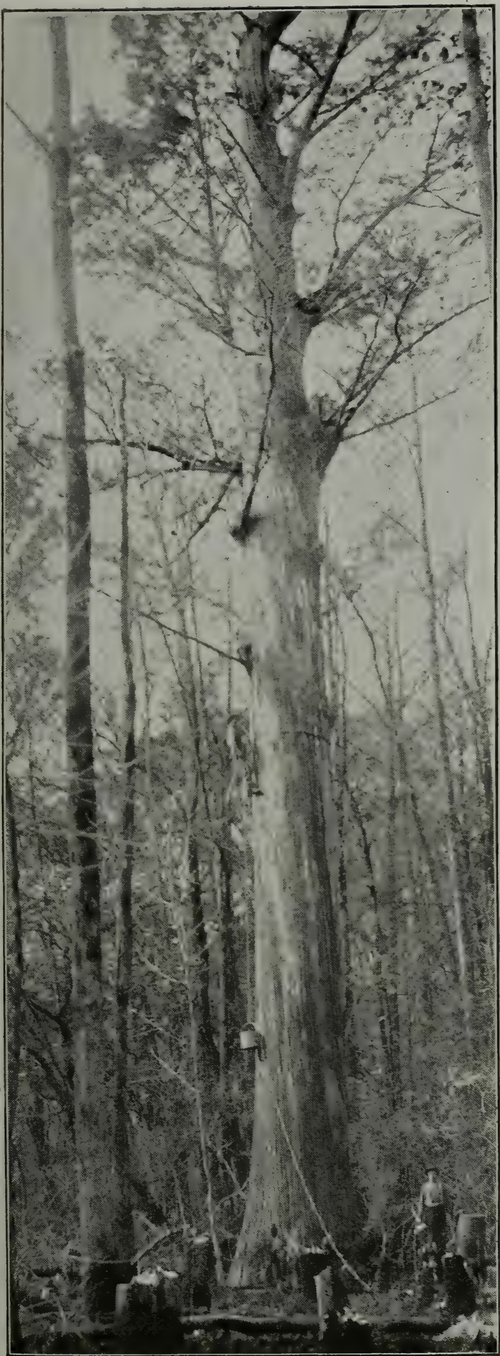
* Since this was written, an A B C scholar says: "Bees vary in their flight. But I have found that on an average they will fly a mile in five minutes, and spend about two minutes in the hive or tree. Of course, they will spend more time in a tree when they have to crawl a long distance to get to the brood-nest, hence we may deduce the rule: Subtract two from the number of minutes absent, and divide by ten. The quotient is the number of miles from the stand to the tree. (See GLEANINGS, 1887, page 431.) This applies to a partially wooded country. Perhaps in a clearing they could make better time. On a very windy day it takes them longer to make trips.

have two or more lines working from the same bait. When a bee comes back, you will recognize it by the peculiar inquiring hum, like robbers in front of a hive where they have once had a taste of spoils. If the tree is near by, each one will bring others along in its wake, and soon your box will be humming with a throng so eager that a further filling of the feeder from the bottle will be needed. As soon as you are pretty well satisfied in which direction they are located, you can close the glass slide and move along on the line, nearer the woods. Open the box, and you will soon have them just as busy again; mark the line and move again, and you will very soon follow them to their home. To aid you in deciding just where they are, you can move off to one side and start a cross-line.* Of course the tree will be found just where these lines meet; when you get where you think they should be, examine the trees carefully, especially all the knot-holes, or any place that might allow bees to enter and find a cavity. If you place yourself so that the bees will be between you and the sun, you can see them plainly, even if they are among the highest branches. Remember you are to make a careful and minute examination of every tree, little and big, body and limbs, even if it does make your neck ache. If you do not find them by carefully looking the trees over, go back and get your hunting-box, bring it up to the spot, and give them feed until you get a quart or more at work. You can then see pretty clearly where they enter. If you do not find them the first day, you can readily start them again almost any time, for they are very quick to start, when they have once been at work, even though it is several days afterward. Bees are sometimes started by burning what is called a "smudge." Get some old bits of comb containing bee-bread as well as honey, and burn them on a small tin plate, by setting it over a little fire. The bees will be attracted by the odor of the burning honey and comb, and, if near, will sometimes come in great numbers.

A spy-glass is very convenient in finding where the bees go in, especially if the tree is very tall; even the toy spy-glasses sold for 50 cents or a dollar are sometimes quite a help. The most serviceable, however, are the achromatic opera-glasses that cost from $3.00 to $5.00. With these we can use both eyes, and the field is so broad that no time is lost in getting the glass instantly on the spot. We can, in fact, see bees with them in the tops of the tallest trees almost as clearly as we can see them going into hives placed on the ground.

After you have found the tree, probably you will be in a hurry to get the bees that you know are there, and the honey that *may* be there. Do not fix your expectations too high, for you may not get a single pound of the latter. Of two trees that we took a few years ago, one contained just about as much honey as we had fed them, and the other contained not one visible cell full. The former were fair hybrids, and the latter well-marked Italians. If the tree is not a valuable one, and stands where timber is cheap and plentiful, perhaps the easiest way is to cut it down. This may result in a smashed heap of ruins, with combs, honey, and bees all mixed up with dirt and rubbish, or it may fall so as to strike on the limbs or small trees, and thus ease its fall in such a way as to do very little injury to the tree or contents. The chances are rather in favor of the former, and on many accounts it is safer to climb the tree and let the bees' part down with a rope. If the hollow is in the body of the tree, or so situated that it can not be cut off above and below, the combs may be taken out and let down in a pail or basket; for the brood-combs, and such as contain but little honey, the basket will be rather preferable. The first thing, however, will be to climb the tree; and as we would be very sorry to give any advice in this book that might in any way lead to loss of life, we will, at the outset, ask you not to attempt climbing unless you are, or can be, a very careful person. An old gentleman who has been out with us remarked that he once knew a very expert climber who took all the bees out of the trees for miles around, but was finally killed instantly by letting his hands slip as he was getting above a large knot in the

* The same writer says further: "It is a waste of time to look for the bee-tree, or to make cross-lines, until you get beyond the tree. When the bees fly back on the line, you may rest assured that you are beyond the tree. Move your last two stands closer together (lining the bees carefully), so that they are only ten or fifteen rods apart. Now, as you have bees flying from two directions into the tree you will probably discover where they are immediately. But if you fail to find them easily, take a stand at one side, eight or ten rods, and cross-line. This is the only place that I find a cross-line of any advantage."—*See Gleanings in Bee Culture, Vol. XV., page 771.*


A bee-tree eleven feet in diameter climbed by Green Derrington.

tree. We do not wish to run any risks where human life is at stake.

CLIMBERS FOR BEE-HUNTERS.

For climbing trees 12 or 18 inches in diameter, a pair of climbers should be used, such as can be obtained at any telephone office.

If the tree is large, the climber provides himself with a withe or whip, of some tough green bough, and bends this so it will go around the trunk, while an end is held in each hand. As he climbs upward, this is hitched up the tree. If he keeps a sure and firm hold on this whip, and strikes his feet into the trunk firmly, he can go up the most forbidding trees rapidly and safely. Some light cord, a clothes-line, for instance, should be tied around his waist, so he can draw up such tools as he may need. Those needed are a sharp ax, a hatchet, saw, and an auger to bore in to see just how far the hollow extends. If the bees are to be saved, the limb or tree should be cut off above the hollow, and allowed to fall. A stout rope can be then tied about the log hive, passed over some limb above, the end brought down and wrapped about a tree until the hive is cut off ready to lower. After it is down, let it stand an hour or two, or until sundown, when all the bees will have found and entered the hive; then cover the entrance with wire cloth, and take it home.

There are some trees, indeed, so large that it would be impossible to climb them with the implements already given. A very ingenious plan, however, has been put into execution by Mr. Green Derrington, of Poplar Bluff, Mo. We give his description, together with an engraving made from a photograph which he sent.

I send you a photograph of a very large tree, which I climbed by means of spikes and staples. To prevent the possibility of falling I put a belt under my arms. To this I attached two chains. At the end of each chain is a snap. My method of climbing is as follows: After ascending the ladder as far as I can go I drive into the side of the tree a large bridge spike, far enough into the wood to hold my weight. A little further up I drive another spike. In between the spikes I drive the first staple, and to this I attach the first chain by means of the snap, and ascend by the nails as far as the chain will allow me; I then drive another staple, and attach the other chain, and next loosen the lower snap. After driving in more spikes, I again ascend as high as the chain will allow me, and attach the other chain to another staple. In this manner I can make my ascent with perfect security.

The tree stands close to the Black River, in a graveyard, and from it I obtained 50 lbs. of honey. Regular climbers are excellent for small trees, say from two to three feet in diameter; but the tree illustrated has such a rough and uneven bark, and is so large that it would be difficult to climb it without the aid of spikes and the staples I have mentioned. On account of the large knots it would be impossible to use a rope, or something similar, to hitch up by climbers, as described in the A B C book. Knots are not in my way when I use spikes and staples. GREEN DERRINGTON.

Poplar Bluff, Mo.

HOW TO GET BEES OUT OF BEE-TREES OR FROM BETWEEN THE SIDINGS OF A HOUSE WITHOUT MUTILATING EITHER THE TREE OR THE HOUSE.

It sometimes happens that a colony of bees will take their abode in some fine shade tree in a park, which the authorities will not allow to be cut: or they will domicile in the woods of some farmer, who, while he will allow the bee-hunter to get the bees, will not let him cut the tree; or, as it often happens, a colony will make its home between the plaster and the clapboarding of a house. How, then, can such bees and their honey be secured without doing any damage to the tree or the building that gives them a home and protection? The matter is made very easy by the use of the modern bee escape. For particulars regarding this device, see COMB HONEY and EXTRACTED HONEY.

Having the bees located in the bee-tree, the hunter prepares a small colony of bees or a nucleus, putting it into a light hive or box which can be carried to the scene of operations. He takes along with him a hammer, a saw, some nails, and lumber, with which he can make a temporary platform. On arriving on the spot he lights his smoker and then prepares to set up this platform directly opposite or in front of the flight-hole of the bee-tree, or the knot-hole, of the dwelling. The platform he constructs out of the lumber he has brought. Before doing so it will be necessary for him to blow smoke into the flight-hole, in order to prevent bees from interfering with the building of the temporary hive-stand. He next puts a Porter bee escape over the flight-hole of the tree, in such a way that the bees can come out but not go back in. Last of all he places his hive with the bees which he has brought, with its entrance as near the bee escape (now placed over the old entrance) as he can.

His work is now complete, and he leaves the bees to work out their own salvation.

The bees from the tree, as fast as they come out, are, of course, unable to return. These, one by one, find their way into the hive on the temporary platform. At the end of four or five weeks the queen in the tree or dwelling will have very few bees left, and there will also be but little brood for that matter, through lack of bees to take care of it, for her subjects are nearly all in the hive on the outside.

At this time Mr. Bee-hunter appears on the scene. He loads his smoker with fuel (brimstone), removes the bee escape and brimstones the old colony, or what is left, which by this time is probably not more than a handful of bees with the queen.

Again he leaves the scene of operation; but the bee escape is not replaced. What happens now? The bees in the hive, including those that were captured, rob all the

Two-foot log split open, exposing large colony of bees.

honey out of the old nest in the tree or house in the course of three or four days, carrying it into the hive on the extemporized platform.

The bee-hunter now takes away the hive, removes the temporary hive-stand and carries the bees home. If they be taken a mile or a mile and a half they will stay where placed.

In the meantime, no damage has been done either to tree or building, as the case may be. All that will be left in the tree will be some old dry combs which, in the form of wax, probably would not amount

A dissected bee-tree. This shows the general arrangement of combs in the cavity. Fortunately in this case the swarm was accommodating enough to make the nest close to the ground where easily captured.

to fifty cents, if the time of rendering be taken into account.

This method of taking bees could not very well be practiced where the bees are located in inaccesible positions, as in high trees; but it will be found very useful where a colony is located in some building or shade-tree in a park.

We are indebted for the general principles here set forth to Mr. Ralph Fisher, of Great Meadows, N. J., who has practiced this plan with great success.

DOES BEE-HUNTING PAY?

If you can earn a dollar per day at some steady employment, we do not think it would, as a rule; yet there are doubtless localities where an expert would make it pay well in the fall of the year. With the facilities we now have for rearing bees, a beekeeper could stock an apiary much quicker by rearing bees than he would by bringing them home from the woods, and transferring. In the former case he would have nice straight combs, especially if he used foundation; but the combs from the woods would require a great deal of fussing, and yet would never be nearly as nice as those built on foundation, even then. So much by way of discouragement. On the other hand, a ramble in the woods, such as bee-hunting furnishes, is one of the most healthful forms of recreation one can find, because it gives one a chance to study, not only the habits of the bees, but the flowers as well; for in hunting for a bee to start with we find many plants that are curious and many that we would not otherwise know bees frequent.

BEEKEEPING AS A SPECIALTY.— See Beginning with Bees and Profits in Bees.

BEEKEEPING FOR WOMEN.

[It is presumed, of course, that no ordinary *man* would be *entirely* competent to write on a subject of this kind. In looking about for some lady to do this, the authors could think of no one more able than Mrs. Anna B. Comstock, author of a charming work for beginnners on "How to Keep Bees." Mrs. Comstock is the wife of Prof. J. Henry Comstock, of Cornell University, and both of them entomologists. We engaged her to write the article, and here it is:]

Two questions invariably pop up at us when this matter of feminine beekeeping is discussed: One is, "Why shouldn't a woman keep bees?" and the other is, "Why should a woman keep bees?" Like most other questions these may be answered more or less rationally with proper consideration.

Taking the "why shouldn't" question first, we are bound to confess that nowadays there is no effective reason why a woman should not do almost any thing that she takes into her enterprising little head to do. But quite aside from the consideraation of woman's prowess, there are one or two reasons that might deter some of the faint-hearted fair from undertaking beekeeping. There is no use trying to gloss over the fact that there is a great deal of hard work and heavy lifting in the care of a profitable apiary. The hard work is really no objection, as most women of whatever class are at it any way. But lifting heavy hives is certainly not particularly good exercise for any woman, although I must confess that I have never lifted half so strenuously when caring for bees as I used to on the farm when we moved the cook-stove into the summer kitchen, accomplishing this feat by our feminine selves, rather than bring to the surface any of the latent profanity which seems to be engendered in the musculine bosom when taking part in this seasonal hegira.

There are at least two ways of obviating this feminine disability in beekeeping. One, practiced succesfully by several women, is through the use of a Boardman hive-cart, which almost solves the problem if the bees are wintered out of doors, and do not have to be carried up and down cellar stairs; the other method is to get some man to do the lifting and carrying.* It may be the husband, the father, the brother, the son, or the hired man; but as this work can be done at a time which can be planned for, it is not so difficult for the men of the establishment to give the help needed. I am sure my husband would say that I am quite enthusiastically in favor of the man solution of this problem; but his opinion does not count for much, because he loves the bees so enthusiastically I have to beg for a chance to work with them at all, although he virtuously points out the hives to people as "Mrs. Comstock's bees."

Another "shouldn't" reason might be that women are afraid of bee-stings. This falls flat, from the fact that women are not a bit more nervous than men in this respect.

* Some frail women remove all honey, one comb at a time.—A. C. M.

This year when I was struggling to hive a swarm from a most difficult position, an interested man stood off at a safe distance in a most pained state of mind. He was a courteous gentleman, and he felt that it was outrageous for me to have to do the work alone, but he did not dare to come to my aid, and I think he considered my temerity in dealing with the swarm as almost scandalous.

Thus having disposed of all the reasons I can think of why women shouldn't keep bees, I turn gladly to the more interesting reasons why she should look upon the apiary as one of her legitimate fields of labor. There are so many reasons for this that I could not enumerate them even if a complete number of a bee journal were given me for the purpose. So I shall speak of just a few of the most cogent reasons. I should put first of all, and as embracing all other reasons, that beekeeping may be made an interesting avocation which can be carried on coincidentally with other employments; it is an interesting study in natural history; it cultivates calmness of spirit, self-control and patience; it is a "heap" of fun; incidentally it may supply the home table with a real luxury; and it may add a very considerable amount to any woman's spending-money. It can also be carried on as a regular business, to support a family.

But it is as an avocation that I am especially interested in the apiary. Any woman who keep house needs an avocation to take the mind and attention completely off her household cares at times. There is something about the daily routine of housekeeping that wears mind and body full of ruts, even in the case of those who love to do housework better than any thing else. Talk about the servant question! It is not the servant question, but the housework question. If some means could be devised by which housework could be performed with inspiration, zeal, and enthusiasm, the servant problem would solve itself; but this ideal way of doing housework can be carried on only when the spirit is freed from the sense of eternal drudgery. I am not a wizard to bring about this change; but I know one step toward it, and that is the establishment of some permanent interest for woman that will pull her out of the ruts and give her body and mind a complete change and rest. Embroidery, lacemaking, weaving, painting, and several other like occupations, may serve this purpose in a measure; and, perhaps, if carried on in the right way, may achieve more in this line than they do at present. But these are all indoor occupations; and what a woman needs is something to take her out of doors where she can have fresh air. Excess of perspiration induced by the cookstove is weakening; but honest sweat called forth in the open air by the application of generous sunshine is a source of health and strength.

Beekeeping is one of the best of these life-saving, nerve-healing avocations; it takes the mind from household cares as completely as would a trip to Europe, for one can not work with bees and think of any thing else. Some of the attributes which make beekeeping an interesting avocation I will mention: First of all, bees are such wonderful creatures, and so far beyond our comprehension, that they have for us always the fascination of an unsolved problem. I never pass our hive without mentally asking, "Well, you dear little rascals, what will you do next?" Bees are of particular interest to every woman for several reasons: if she likes good housekeeping, then the bee is a model; if she likes a woman of business, again is the bee a shining light; if she is interested in the care of the young, then is the bee-nurse an example of perfection; if she believes in the political rights of woman, she will find the highest feminine political wisdom in the constitution of the bee commune. In fact, it is only as a wife that the bee is a little too casual to pose as ideal, although as a widow she is certainly remarkable and perhaps even notorious.

Another phase which makes beekeeping a pleasing avocation for women is that much of the work is interesting and attractive. I never sit down to the "job" of folding sections and putting in starters without experiencing joy at the prettiness of the work. And if there is any higher artistic happiness than comes from cleaning up a section holding a pound of well-capped amber honey and putting the same in a dainty carton for market, then I have never experienced it; and the making of pictures has been one of my regular avocations. By the way, woman has never used

her artistic talent rightly in this matter of cartons. Each woman beekeeper ought to make her own colored design for the carton, thus securing something so individual and attractive as to catch at once the eye of the customer.

As a means of cultivating calmness, patience, and self-control the bee is a well-recognized factor. Bees can be, and often are, profoundly exasperating; and yet how worse than futile it is to evince that exasperation by word or movement! No creature reacts more quickly against irritation than the bee. She can not be kicked nor spanked; and if we smoke her too much, we ourselves are the losers. There is only one way to manage exasperation with bees —that is, to control it; and this makes the apiary a means of grace.

The money-making side of beekeeping is a very important phase in arousing and continuing the woman's interest in her work. I think woman is by birth and training a natural gambler, and the uncertainties of the nectar supply and of the honey market add to rather than detract from her interest in her apiary. I know of several women who have made comfortable incomes and supported their families by beekeeping; but, as yet, I think such instances are few. However, I believe there are a large number of women who have added a goodly sum yearly to their amount of spending money, and have found the work a joy instead of drudgery. Personally, I have had very little experience with the commercial side of beekeeping. Once when our maddeningly successful apiary grew to forty hives when we did not want more than a dozen at most, and the neighborhood was surfeited with our bounty, we were "just naturally" obliged to sell honey. We enjoyed greatly getting the product ready for market, and were somehow surprised that so much fun could be turned into ready cash. As a matter of fact, both my husband and myself have absorbing vocations and avocations in plenty, so that our sole reason for keeping bees is because we love the little creatures, and find them so interesting that we would not feel that home was really home without them; the sight of our busy little co-workers adds daily to our psychic income. We are so very busy that we have but very little time to spend with them, and have finally formulated our ideal for our own beekeeping, and that is to keep bees for honey and for "fun." We shall have plenty of honey for our own table, and just enough to bestow on the neighbors so they will not get tired of it; and fun enough to season life with an out-of-door interest and the feeling that no summer day is likely to pass without a surprise.

BEEKEEPERS' SOCIETIES. — See Organization of Beekeepers.

BEE LEGISLATION. — See Legislation on Bees.

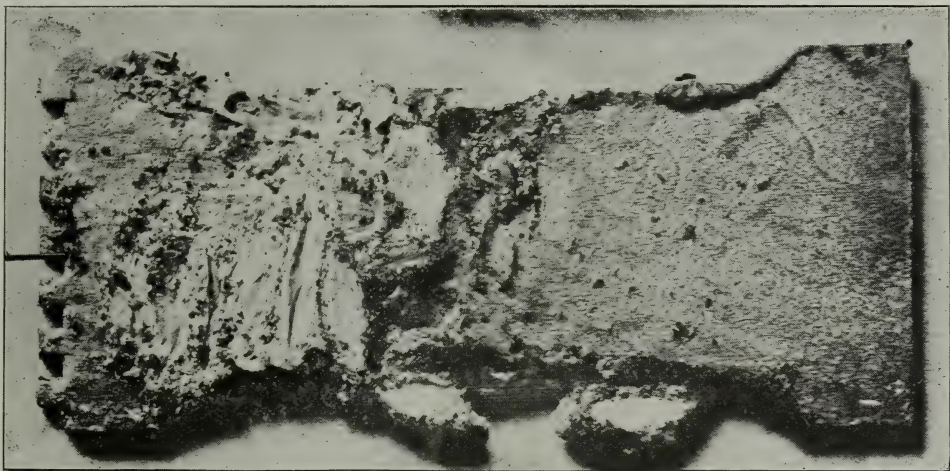
BEE-MOTH.—When you hear a person complain that the wax-worm killed his bees, you can set him down at once as knowing very little about bees; and if a hive is offered you that has an attachment or trap to catch or kill moths, you may set the vender down as a swindler, or one who is not acquainted with modern methods for keeping bees. A man who will take upon himself the responsibility of introducing hives, without knowing something of our modern books and bee-journals, should receive treatment sufficiently rough to send him home, or into some business he understands.

When a colony gets weakened so much that it can not cover and protect its combs, robbers and wax-worms help themselves as a natural consequence; but either one rarely does any harm if there are plenty of bees and a clean tight hive. If a hive is so made that crevices will admit a worm, and not allow a bee to go after it, it may make some trouble in almost any colony; and we can not remember that we ever saw a patented moth-proof hive that was not much worse in this respect than a plain simple box hive. A plain square box is, in fact, all we want for a hive; but as we must have the combs removable, we require frames to hold them; and if these frames are made so that bees can get all around and about them, we have done all we can to make a moth-proof hive.

Of course, colonies will at times get weakened; and under the best of care, with old-fashioned black bees especially, worms will sometimes be found in the combs. Now if you have the simple hives shown in these pages you can very quickly take out the combs, and with the point of your knife

remove every web and worm, scrape off the debris, and assist the bees very much. Where there is an accumulation of filth on the bottom-board, lift out all the combs and brush it off, and be sure you crush all the worms therein, for they will crawl right back into the hive if carelessly thrown on the ground.

If you keep only Italians, or even all hybrids, you may go over a hundred colonies and not find a single trace of wax-worms. Indeed, since Italians or their crosses are now used so extensively, and the old black bees so rarely, the moth-worm has all but disappeared. The readiest way we know of to get combs that are badly infested free from worms is to hang them, one at a time, in the center of a hive full of Italians. You will find all the webs and worms strewn around the entrance of the hive in a couple of hours, and the comb cleaned up nicer than you could do it if you were to sit down all day at the task.



A sample of how the eggs and cocoons of the bee-moth are deposited on wood. Sometimes the wood is grooved or eaten out. The illustration fails to convey the real filthiness of the mass.

Occasionally you will find that webs and cocoons are deposited back of the division-board or in some crack or crevice of the hive. Sometimes they will be located between the tops of the sections and the super-cover. The illustration gives a fair sample of how they may be built up against the wood. In such cases you will find how the moth has burrowed or gnawed the wood.

HOW TO KEEP EMPTY COMBS SECURE FROM THE WAX-WORMS.

With the Italians only, you may have no trouble at all, without using precaution; but where black bees are around you, kept in the old-fashioned way, or in patent hives, you will be very apt to have trouble unless you are careful. Suppose, for instance, you take a comb away from the bees during the summer months, and leave it in your honey-house several days. If the weather is warm you may find it literally infested with small worms, and in a few days more the comb will be entirely destroyed. Combs partly filled with pollen seem to be the especial preference of these greedy, filthy-looking pests, and we have sometimes thought they would do but little harm were it not for the pollen they find to feed on. A few years ago we used to have the same trouble with comb honey when taken from the hive during the early part of the season; but of late we have had less and less of it; and during late years we have hardly seen a wax-worm in our comb honey at all, and we have not once fumigated our honey-house. We ascribe this to the increase of Italians in our own apiary, and those all about us, for the most of the bees in the woods are now partly Italianized. These have driven the moth before them to such an extent that they bid fair soon to become extinct. Perhaps much has been also done by keeping all bits of comb out of their way; no rubbish that would harbor them has been allowed to accumulate; and as soon as any has been found containing them, it has been promptly burned. Those who take comb honey from hives of common bees are almost sure to find live worms sooner or later.

How do worms get into a box of honey that is pasted up tightly, just as soon as the bees are driven out? Possibly just as they get into a comb taken from the hive during warm weather. The moth has doubtless been all through the hive, for it can go where a bee can, and has laid eggs in every comb, trusting to the young worms to evade the bees by some means, after they are hatched. This explanation, we are well aware, seems rather unreasonable, but it is the only one we can give. In looking over hives of common bees, we have often seen moths flit like lightning from crevices, and have sometimes seen them dart among the bees and out again; but whether they can deposit an egg so quickly as this, we are unable to say. In taking combs from a hive containing queen-cells to be used in the lamp nursery we have always had more or less trouble with these wax-worms. The high temperature and absence of bees are very favorable to their hatching and growth, and after about three days worms are invariably found spinning their webs. If they are promptly picked out for about a week, no more make their appearance, showing clearly that the eggs were deposited on the combs while in the hive.

When queen-cells are nearly ready to hatch, we often hear the queens gnawing out, by holding the comb close to the ear. In the same way we hear wax-worms eating their galleries along the comb; and more than once we have mistaken them for queens. They are voracious eaters, and the "chanking" they make, when at full work, reminds one of a lot of hogs. As they are easily frightened you must lift the combs with great care either to see or hear them at their work.

Their silken galleries are often constructed right through a comb of sealed brood, and they make murderous work upon unhatched bees. Perhaps a single worm will mutilate a score of larvæ before it is dislodged. These are generally found at the entrance of the hive in the morning; and numerous letters have been received from beginners, asking why their bees tear the unhatched brood out of the combs and carry it out of the hives. Possibly the moth is at the bottom of all or nearly all these complaints.* If you examine the capped brood carefully you will see light streaks across the combs where these silken galleries are; and a pin or a knife-point will soon pry his wormship out of this retreat. As the young worms travel very rapidly it is quite likely that the eggs may have been deposited on the frame or edges of the comb. It is a little more difficult to understand how they get into a honey-box with only a small opening, but we think it is done by the moth while on the hive.

* Brood that has been chilled in early spring or overheated from any cause will be carried out in the same way.—A. C. M.

How moths ruin combs that are not taken care of.

You may, perhaps, have noticed that the moth-webs are usually seen between one comb and another, and they seldom do very much mischief unless there are two or more combs side by side. Well, if in putting away your surplus combs for winter you place them two inches or more apart, you will seldom have any trouble, even should you leave them undisturbed until the next July. There is no danger from worms, in any case, in the fall, winter, or spring, for the worms can not develop unless they have a summer tempera-

ture, although they will live a long time in a dormant state if not killed by severe freezing weather. We have kept combs in our barn two years or more; but they were not removed from the hives until fall and were kept during the summer months in a close box where no moth could possibly get at them. We have several times had worms get among them when we were so careless as to leave them exposed during warm weather; and one season we found nearly a thousand combs so badly infested that they would have become almost worthless in less than a week. The combs were all hung up in the honey-house, and about a pound of brimstone was thrown on a shovel of coals in an old kettle. This was placed in the room, and all doors and windows carefully closed. Next morning we found most of the worms dead; but a few encased in heavy webs still lived. After another and more severe fumigation, not a live one was to be found, and our combs were saved. We have several times since fumigated honey in boxes in the same way. The following extract from Burt's *Materia Medica* contains some hints valuable to apiarists as well as to doctors:

In the form of *sulphurous-acid fumes*, or gas, sulphur is the most powerful of all known agents as a disinfectant and deodorizer. To disinfect a room and clothing from infectious diseases, as smallpox, etc., first close up the chimney and paste up all crevices of the windows and doors to prevent the escape of gas. Now raise all carpets, and hang up the clothes so that the fumes of gas may have complete access to them. When this is done, set a tub in the center of the room with six inches of water in it. In the center of this water place a stone that comes just above the water. On this stone set an iron vessel with two pounds of sulphur broken up into quite fine pieces or lumps; on this pour a few ounces of alcohol, to make the sulphur burn readily; set the alcohol on fire, and leave the room, closing the door behind you. It is well to repeat this fumigation three or four times.

After the bees have died in a hive, it should never be left exposed to robbers and moths, but should be carried indoors at once, or carefully closed up. If you have not sufficient bees either by artificial or natural swarming to use the combs before warm weather, keep careful watch over them, for a great amount of mischief may be done in a very few days. We once removed some combs, heavy with honey, in August, and, thinking no worms would get into them so late, we delayed looking at them. A month later honey began to run out on the floor; and upon attempting to lift out a comb it was found impossible to do so. When all were lifted up at once, a mass of webs nearly as large as one's head was found, in place of honey and combs. So much for not keeping a careful watch over such property.

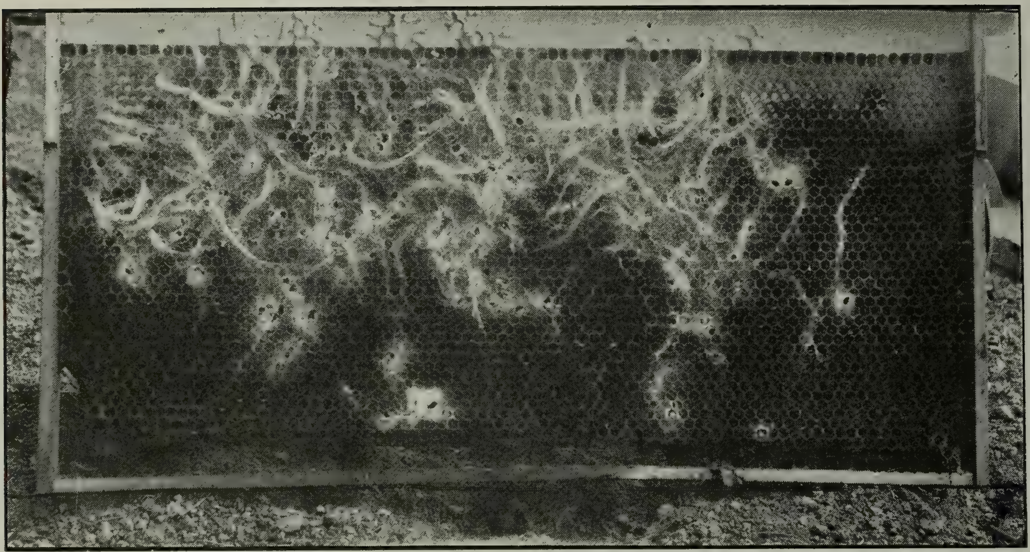
The practice in late years is to use bisulphide of carbon—the same drug that is spoken of under the head of ANTS. The combs to be treated are placed in a tool-box or a small room. A pint or a quart of the liquid, depending on the size of the inclosure, is then placed in an open vessel *above* the combs. The stuff is very volatile and evaporates quite rapidly; and the fumes, being heavier than air, settle down, passing around and through the combs.

One should be very careful in handling this drug lest he inhale the fumes of it, although a few breaths would probably cause no harm except a little dizziness. Every thing being in readiness, pour out the liquid in the right place, and shut up the inclosure. On account of the fearfully explosive nature of bisulphide of carbon, it is advisable to use a large box or cupboard outdoors. One can, of course, use it in a building or room; but first be sure there is no lighted fire, a lamp, nor any thing that might ignite the explosive gas.

HOW TO KEEP EMPTY COMBS.

When combs are left in spring, after the death of the bees in a hive, there is no safer place to put them than in the care of a good strong colony. Brush off the dead bees and put the combs in a clean hive on the stand of a strong colony, and then place the colony *over* this hive of empty combs, so that they will be obliged to pass through the hive of combs to go in or out. In other words, give the bees no entrance except that of the lower hive, allowing free communication between the two. The combs will then be kept free from worms and mold, with no care whatever on your part, except to keep the entrance so small for two or three days at first that robbers will not trouble.

After the weather has become warm, three or four stories of empty combs may be piled over a queen-excluder on top of a hive containing a colony; then a frame of brood in the upper story will make sure that the bees traverse all the combs.



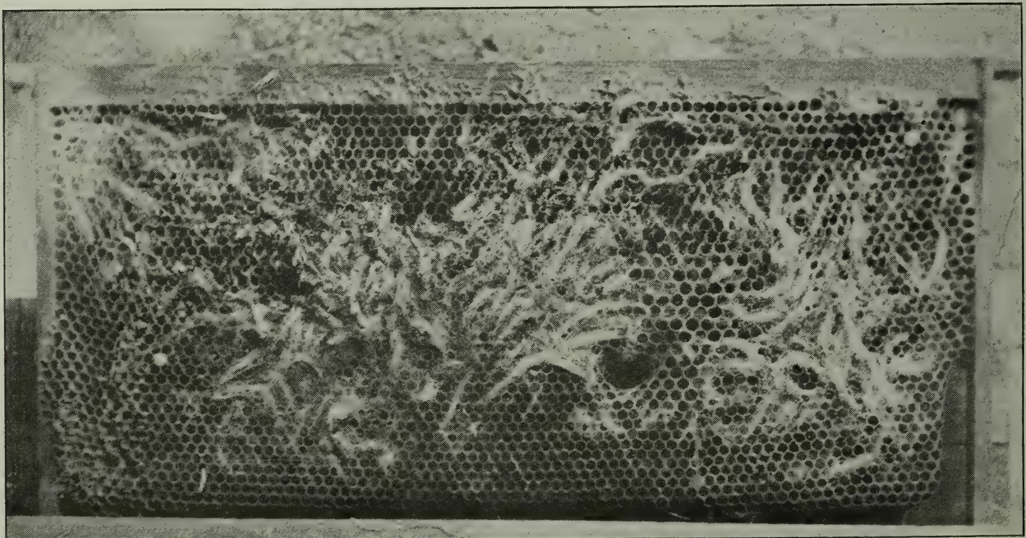
Combs infested by the lesser wax-moth. This photograph was sent us by George W. Tebbs, Hespeler, Ontario, Canada, who wrote that the frame was taken from a hive which had originally contained an Italian colony, but which had been empty during the winter.

BEE-MOTH IN HIGH ALTITUDES.

In Colorado, at least in the region of Denver, where the elevation is fully a mile above the level of the sea, the ordinary wax-moths are unknown. The great elevation seems to be more than they can stand. There is, however, a very small wax-worm, but it is not the same that ordinarily troubles beekeepers.

The Government Entomologist for New South Wales, Australia, Mr. Sidney Olliff, wrote an article on the subject of bee-moths for the New South Wales *Agricultural Gazette*. There is so much of value in it, especially as it describes the same pest we have here, that we have decided to reproduce it in these columns. The illustration accompanying it is especially accurate.

The bee-moths, or beeswax-moths, of which there are two distinct kinds commonly found in Australia, are so well known, and have been so frequently figured and described, that it will not be necessary to give very detailed or technical descriptions of them here. A considerable number of inquiries have been received during the past few years regarding these destructive moths, chiefly from amateur beekeepers; and it may, therefore be useful to publish a few notes concerning the habits and seasonable appearance of these insects in Australia, more especially as I am able to add some information regard-



Work of the Mediterranean flour-moth.

Beeswax moths.

ing remedial and preventive measures for the suppression of the pests, which have been found satisfactory by experienced beekeepers. The larger of the beeswax-moths—properly known as *Galleria mellonella,* Linn., but sometimes called by the name *Galleria cereana,* Fabr.—appears to be by far the more destructive of the two insects. It is a very widely distributed species, being found throughout Europe and North America, in India, and even in the cold regions of Northern Siberia; indeed, it appears to have a range that is co-extensive with that of the hive-bee itself. In warm countries it is much more abundant, and therefore destructive, than in temperate or cold climates, a fact which is probably accounted for by the varying number of generations which occur in a season under different climatic conditions. With us in New South Wales the first brood of moth appears in the early spring from caterpillars which have passed the winter in a semi-dormant condition, within the walls of their silken coverings, and turn into pupæ or chrysalids only upon the approach of warm weather. These winter (or hibernating) caterpillars feed very little, and usually confine their wanderings to the silken channels which they have made for themselves before cool weather sets in. Upon the return of desired warmth these caterpillars spin a complete cocoon for themselves and then turn into the chrysalis stage, whence, from ten days to a fortnight, perfect moths appear. These then lay eggs in any convenient spot, such as the sides and bottoms of the frames, on the walls of the hive itself, or on the comb. In each case I have had an opportunity of observing the process, the moth chose the sides of the frames, as near to the brood-comb as possible, the young larvæ having a very decided preference for the comb. The larvæ having once made their appearance (usually in from eight to ten days after the laying of the larval eggs) their growth is exceedingly rapid, the average time before they are ready to assume the chrysalis stage being only some thirty days. The average duration of the chrysalis period is about a fortnight, so it can easily be seen with what great capabilities for rapid reproduction we have to deal. As we have said, the number of generations or broods which develop in a season, *i e.,* between early spring and late autumn, varies with locality and climate; but it may be worth while to record that, in my opinion, we have sufficient evidence to prove the existence of four broods in the Sidney district under ordinary circumstances. I have myself bred three generations, or broods, from a comb received in early spring from the Richmond River; and I am convinced that a fourth might have been bred from the same stock but for an unfortunate accident to the eggs obtained from my third brood. Upon first hatching, the larva is pale yellow in color, with a slightly darkened head; and, when full grown, it is of a dull grayish flesh color, with a dark reddish-brown head. Its average length is about an inch, and, like the majority of the caterpillars of moths, it has sixteen legs. The chrysalis of the larger beeswax-moth is of the ordinary type. and is enclosed in a very compact cocoon of tough white silk, usually spun up in one of the silken channels or galleries made by the larva to which we have previously referred. The perfect insect, or moth, has reddish brown-gray forewings, which are distinctly lighter in color toward the outer or hinder margins. The sexes can readily be distinguished by the outline of the wings, as will readily be seen by a glance at the plate acompanying this article.

The second species of beeswax-moth is known as *Achroea grissella,* Fabr., the lesser beeswax-moth, or honey-moth, etc. Although not nearly so destructive as the larger kind, it does considerable damage in old and neglected hives. The moth is much smaller than *Galleria mellonella,* with which, by the way, I have found it associated in the same hive on more than one occasion. It is of a dead gray color, and has a yellow head. This species is not nearly so particular in choosing its food as the former kind (*G. mellonella*), and may frequently be found feeding on the *debris* which commonly collects on the bottom of a neglected hive.

It is a well-known fact, that beeswax-moths do not attack the Italian (Ligurian) bee to any serious extent, which, indeed, are rarely attacked at all. It is the ordinary black or hive bee that suffers so greatly.

EXPLANATION OF PLATE.

BEESWAX-MOTHS.

Fig. 1.—Larva or caterpillar of Larger Beeswax-moth (*Achroea grissella,* Fabr.), side view view (much enlarged).

Fig. 2.—The same viewed from above (much enlarged).

Fig. 3.—Cocoon of same, extracted from bee-comb (enlarged).

Fig. 4.—Larger Beeswax-moth (*Galleria mellonella,* Linn.), male (much enlarged).

Fig. 5.—Forewing of same, female.

Fig. 6.—Larva or caterpillar of Lesser Beeswax-moth (*Achroea grissella,* Fabr.), side view much enlarged.

Fig. 7.—Pupa or Chrysalis of same (much enlarged).

Fig. 8.—Lesser Beeswax-moth (*Achroea grissella,* Fab.), much enlarged.

In the background above, a comb from a frame hive is represented, showing brood-comb tunneled by the larvæ of the larger beeswax-moth (*Galleria mellonella,* Linn.).

The natural sizes of the insects are indicated by hair-line.

BEE PARALYSIS.—See DISEASES OF BEES.

BEE SPACE.—This term is applied to spaces left by the bees both between combs they build and between the parts of the hive and the combs. It varies all the way from 3-16 to 3-8; but 5-16 is considered the correct average. But in hive-construction it has been found that a space of ¼ inch will be more free from the building of bits of comb and the depositing of propolis than a little wider spacing. Any less space than 3-16 will be plugged up with propolis and wax.

Father Langstroth, in the great invention which he gave to the world—the first *practical* movable frame—made the discovery that bees recognize and protect passageways which we now call bee-spaces. Taking advantage of this fact he made a frame for holding comb bee-spaced all around. All who preceded him had failed to grasp the fact that bees would leave such spaces unfilled with wax or propolis. Before Langstroth's time it was necessary to pull out frames stuck fast to the hives with propolis, or tear or cut loose the combs with a thin-bladed knife, before they could be removed for the purpose of inspection.

By bringing out his bee-spaced frame the "father of modern apiculture" solved, with one great master-stroke, a problem that had been puzzling the minds of beekeepers for centuries.

In later years, manufacturers of hives have been compelled to recognize this great principle, that there are certain parts inside the hives that must be bee-spaced from every other part or else they will be stuck or glued together in a way that will make them practically inseparable. For example, the bottoms of supers containing the sections must be ¼ inch above the tops of the brood-frames in the lower part of the hive. The sections themselves must be held a bee-space away from the separators or fences. It has come to be a general practice to put the bee-space in the bottom-board, leaving the bottoms of the frames in the brood-nest nearly flush with the bottom of the hive. This makes it necessary to have the sides and ends of the hive project above the general level of the frames about ¼ inch. In the same way the supers have a bee-space on top but not on the bottom. If a super be removed, and a hive-cover be put in its place, there will still be a space between the cover and the brood-frames.

BEES.—Throughout this work we deal particularly with Italians, the common black bees of this country, and the crosses between the two, because they are used almost exclusively by beekeepers. The crosses are often incorrectly denominated "hybrids;" but as that name has been generally adopted, we retain it. For particulars regarding these bees the reader is referred to HYBRIDS, which see. The Italians are spoken of specifically, also, under the heading of ITALIANS, elsewhere in this work.

BLACK OR GERMAN BEES.

Black bees are so common in nearly every vicinity that very little description is necessary. As the name indicates, they are black. One variety in the South is of a brownish black; another distinctly black, and, if any thing, a trifle smaller.

Comparing the Germans with the Italians, they are more inclined to rob, are not as good workers, but are equal when nectar is abundant, or when there is dark honey like that from buckwheat to be gathered. They are much more nervous; and when a hive of them is opened they run like a flock of sheep from one corner of the hive to another, boiling over in confusion, hanging in clusters from one corner of the frame as it is held up, and finally falling off in bunches to the ground, where they continue a wild scramble in every direction, probably crawling up one's trousers-leg, if the opportunity offers. Their queens are much harder to find, the bees are not so gentle, and, worse than all, they have a disagreeable fashion of following the apiarist about from hive to hive in a most tantalizing manner. This habit of poising on the wing in a threatening manner before one's eyes is extremely annoying, and some bees will keep it up for a day at a time unless killed. We generally make very short work by smashing them between the palms of our hands, or batting them to death with little paddles we keep near. It is useless to strike at individual bees while they are in the air, for one is much more liable to miss than to hit them. Our practice is to take two sticks, one in each hand, and work them back and forth in front of our face very rapidly, just about as one would operate a fan on a hot day. This rapid movement excites anger in the bees, with the result that they make a dive for the whirling sticks; and in less time than it takes to tell it, one by one they get their heads rapped, and go down into the grass.*

Comb honey from the blacks is a little whiter, if any thing, than that made by pure Italians, because the capping is raised up, leaving a slight air-gap between it and the surface of the honey in the cell. But this difference in the whiteness of capping is so very slight as compared with that on comb honey made by the Italians that it really cuts no figure in the market. The blacks are also much easier to shake off the combs than pure Italians, which can hardly be shaken off, and some prefer blacks or hybrids, when extracting, for that reason alone.

CARNIOLANS.

The Carniolans, evidently a variety of black bees, which they very much resemble, were introduced into this country in 1884, or thereabout. They are said to be very gentle; but the few colonies we have tried are no more so than average Italians, and

* A piece of wire window-screen three or four inches square, tacked to a stick, is more effective. It creates no draft, and the bees can not dodge it. —A.C. M.

in one case they were more vindictive than the Cyprians. As stated, they resemble blacks, and might easily be mistaken for them; but there is a difference. They are larger, and their abdomens are of a more bluish cast, the fuzzy rings being very distinct. They are gentler, as a rule, and do not, like the blacks, boil over in confusion when the hive is opened, although one of our Carniolan colonies did this very thing. They have not the fixity of character of the Italians—colonies of the same race differing quite widely. The general verdict is, that they are excessive swarmers, and this trait alone makes them very undesirable. Their close resemblance to black bees makes it difficult to detect the crosses of the two races. This fact, coupled with their great swarming propensity, will largely prevent their meeting with general favor.

WORKER

QUEEN

DRONE

But the Carniolans have one good trait in their favor, and that is, they deposit as little propolis as any bees ever known. Some colonies that we had, actually deposited almost none. In the production of comb honey this is quite an important item. See Crosses of Bees under HYBRIDS.

CAUCASIANS.

This is a race that looks very much like Carniolans and the common black bee of this country, but it resembles the latter more than the former. So close is the general resemblance that even experts in some cases have been unable to distinguish them. But there is a vast difference in their general habits and temperament.

The claim has been made that Caucasians are the gentlest bees known; and this claim, in part, at least, has been established, although they are no more so than some good strains of pure Italians. Bee-men are not agreed, however, as to their honey-gathering qualities. Some consider them very inferior while others believe they are equal to any race in this respect. All admit that they are bad propolizers, sticking large chunks of gum in all parts of the hive—a trait that becomes more manifest as cold weather comes on. In this one respect they differ materially from Carniolans.

About the most serious objection that can be urged against them (and the same may be said of Carniolans) is very strong resemblance to the common blacks. It will be simply impossible to detect their crosses; and unscrupulous dealers might send out such crosses, or even black bees, and palm them off as Caucasians. But the deception could not continue long, as Carniolans behave very differently on the combs.

BANAT BEES.

These are named from a district of Hungary from which they were imported. They much resemble the Carniolans in appearance and habit but with less inclination to swarm. They are very gentle, and impart this trait to their offspring when crossed with Italians. Even after several generations this character is in evidence. The queens are dark tan color, are no more prolific than good Italians, but they build up the colonies more rapidly in the spring. They are worthy a more extended trial both in their purity and used for crossing.

TUNISIANS.

This black race, natives of North Africa, are sometimes called "Punics." They have been tested to some extent in this country, but so far have not been able to establish any claim in their favor that would entitle

them to consideration on the part of American beekeepers. They are cross, and so inclined to smear everything with a red bee glue that they are entirely unsuited for the production of comb honey. They are no better honey-gatherers than gentler races.

EGYPTIANS.

The Egyptian bee is reputed the most beautiful species of *Apis*. It has been named *Apis fasiata* by entomologists; has been cultivated for thousands of years by the Egyptians, and was probably the first species reduced by mankind to domestic purposes.

In the time of the ancient historian Herodotus, apiaries were transported up and down the Nile so as to keep pace with the seasons in Upper and Lower Egypt. This practice is continued at the present day to a limited extent. Inscriptions on tombs show the practice in use 4000 years ago, at least, and the honeybee highly reverenced by the people of that age.

The Egyptian bee is so much smaller than the Italian that the two do not hybridize very well; on the contrary, the queen, if compelled to mate with a European drone, frequently dies soon after fertilization. It is probably, however, the mother-species of the Cyprian, Holy-Land, and Grecian bees. It is a fast, excellent worker, but reputed to possess an irritable temper though kept domesticated for thousands of years. Possibly in a climate similar to that of Egypt it would exhibit a better temper than in Northern Europe. It could hardly be otherwise.

In color Egyptians are almost identical with Italians, but in addition have a coat of white hairs, which adds to their appearance. There are varieties, or races, of the same species in countries next to Lower Egypt. One feature of these bees would please Americans, namely, their ability to keep themselves pure and uncontaminated with other races. There is a similar species in Senegal known as *Apis Adansonii*, of which we know but little.

ALBINOS.

Albinos are either "sports" from Italians, or, what is more generally the case, a cross between Holy-Lands and Italians. After testing them in our own apiary we find them little different from common Italians. The fringe, or down, that appears on the rings of the abdomen of young bees is a trifle whiter than usual, yet no one would observe it unless attention were called to it. The queens are very yellow, while the workers, as honey-gatherers, are decidedly inferior, even in the second generation; and when we select light-colored bees or queens for several successive generations, unless careful we develop only a worker progeny lacking ability as honey-gatherers and endurance. By selection we can get almost any thing we want, and that quite speedily with bees; for we can produce several generations in a single season if need be.

EASTERN RACES OF BEES.

Cyprians, Holy-Lands, or Syrians, are mentioned later under the head of ITALIANS. Of other Eastern races we can do no better than to quote what Mr. Frank Benton, formerly Apicultural Expert of the U. S. Department of Agriculture, has said of them in a special bulletin issued by the Department, entitled "Honeybees," containing 118 pages. Mr. Benton spent some months in the jungles of India, in seach of new bees. For this reason, if for no other, he is able to give us authoritative information. From the bulletin above mentioned we make the following extracts:

THE COMMON EAST-INDIAN HONEYBEE.
(*Apis Indica*, Fab.)

The common bee of Southern Asia is kept in very limited numbers and with a small degree of profit in earthen jars and sections of hollow trees in portions of the British and Dutch East Indies. They are also found wild, and build when in this state in hollow trees and in rock-clefts. Their combs are composed of hexagonal wax cells, and are arranged

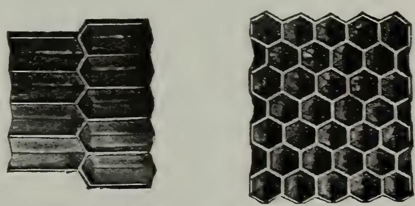


Fig. 1.—Worker-cells of Common East-Indian Honeybee (*Apis Indica*), *natural size.*

parallel to each other like those of *A. mellifica*, but the worker brood-cells are smaller than those of our ordinary bees, showing 36 to the square inch of surface instead of 29; while the comb where worker-brood is reared, instead of having, like that of *A. mellifica*, a thickness of seven-eighths inch, is but five-eighths inch thick. (Fig. 1.)

The workers.—The bodies of these, three-eighths inch long when empty, measure about one-half inch when dilated with honey. The thorax is covered with brownish hair, and the shield or crescent between the wings is large and yellow. The abdomen is yellow underneath. Above it presents a ringed appearance, the anterior part of each segment being orange yellow, while the posterior part shows bands

of brown of greater or less width, and covered with whitish-brown hairs; tip black. They are nimble on foot and on the wing, and active gatherers.

The queens.—The queens are large in proportion to their workers, and are quite prolific; color, leather or dark copper.

The drones.—These are only slightly larger than the workers; color, a jet-like blue-black, without yellow, their strong wings showing changing hues like those of wasps.

Manipulations with colonies of these bees are easy to perform if smoke be used; and, though they are more excitable than our common hive-bees this peculiarity does not induce excessive stinging, but seems rathed to proceed from fear. The sting is also less severe.

Under the rude methods thus far employed in the management of this bee no great yields of honey are obtained, some 10 or 12 pounds having been the most reported from a single hive. It is quite probable these little bees would yield more if imported into this country, since they could no doubt visit many small flowers not frequented by the hive-bees we now have, and whose nectar is, therefore, wasted; but very likely they might not withstand the severe winters of the North unless furnished with such extra protection as would be afforded by quite warm cellars or special repositories.

Here is something exceedingly interesting regarding the smallest honeybees in the world. Just take a look at the size of the

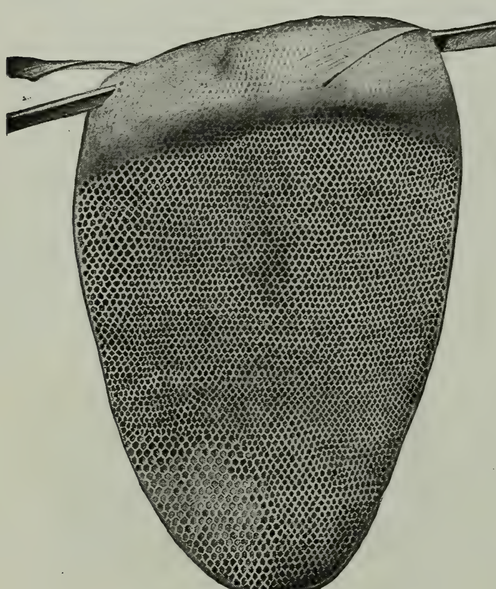


Fig. 3.—Comb of Tiny East-Indian Honeybee (*Apis florea*), one-third natural size.

cells as shown in the figure, natural size, and then compare them in your mind's eye with comb in your own apiary. Well, here is what Mr. Benton has to say:

THE TINY EAST-INDIAN HONEYBEE.
(*Apis florea*, Fab.)

This bee, also a native of East India, is the smallest known species of the genus. It builds in the open air, attaching a single comb to a twig of a shrub, or small tree. This comb is only about the size of a man's hand, and is exceedingly delicate, there being on each side 100 worker-cells to the square inch of surface (Figs. 2 and 3). The workers, more slender than house-flies, though longer-bodied, are blue-black in color, with the anterior

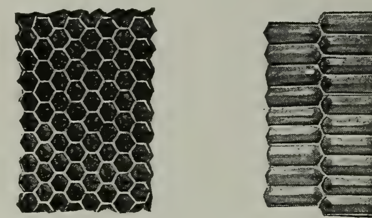


Fig. 2.—Worker-cells of tiny East-Indian Honeybee (*Apis florea*); *natural size.*

third of the abdomen bright orange. Colonies of these bees accumulate so little surplus honey as to give no hope that their cultivation would be profitable.

GIANT BEES OF INDIA.
(*Apis dorsata*, Fab.)

A few years ago a great deal used to be said regarding the East Indian "giant" honeybees, *Apis dorsata,* and the possibilities of having them imported and domesticated in this country. Much truth and nonsense have evidently been circulated in regard to them. Mr. Benton, having been in their native land, gives us something here that can be relied on.

This large bee, which might not inappropriately be styled the Giant East-Indian bee, has its home in the far East—both on the continent of Asia and the adjacent island. There are probably several varieties of this species, more or less marked, and very likely *Apis zonata,* Guer., of the Philippine Islands, reported to be even larger than *Apis dorsata,* will prove on further investigation to be only a variety of the latter. All the varieties of these bees build huge combs of very pure wax—often 5 to 6 feet in length and 3 to 4 feet in width, which they attach to overhanging ledges of rocks or to large limbs of lofty trees in the primitive forest jungles. When attached to the limbs of trees they are built singly, and present much the same appearance as those of the tiny East-Indian bee, shown in the accompanying figure (Fig. 3). The Giant bee, however, quite in contradistinction to the other species of apis mentioned here, does not construct larger cells in which to rear drones, these and the workers being produced in cells of the same size. Of these bees—long regarded as a myth by beekeepers of America and Europe—strange stories have been told. It has been stated that they build their combs horizontally, after the manner of paper-making wasps; that they are so given to wandering as to make it impossible to keep them in hives, and that their ferocity renders them objects greatly to be dreaded. The first real information regarding these points was given by the author. He visited India in 1880-81 for the purpose of obtaining colonies of *Apis dorsata.* These were procured in the jungles by cutting the combs from their original attachments, and it was thus ascertained (as might have been expected in the case of any species of apis), that their combs are always built perpendicularly; also that colonies placed in frame hives and permitted to fly freely did not desert these habitations, and that, far from being ferocious, these colonies were easily handled by proper precautions, without even the use of smoke. It was also proved by the quantity of honey and wax present that they are good gatherers. The execution at that time of the plan to bring these bees

to the United States was prevented only by severe illness contracted in India.

These large bees would doubtless be able to get honey from flowers whose nectaries are located out of reach of ordinary bees, notably those of the red clover, now visited chiefly by bumble-bees, and which it is thought the East-Indian bee might pollinate and cause to produce seed more abundantly. Even if not further utilizable, they might prove an important factor in the production, throughout the Southern States, of large quantities of excellent beeswax, now such an expensive article.

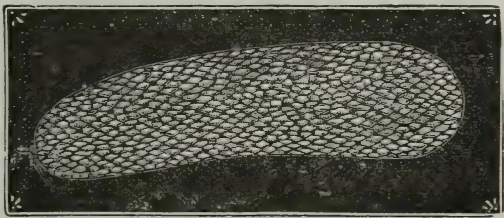
There are a few in this country who believe the introduction of the giant bees here would result disastrously to the business; that, as the English sparrow has driven out some of our American song birds, so *Apis dorsata* might drive out the Italians and black bees by taking the nectar that would otherwise go to *Apis mellifica,* and thus indirectly rob the beekeeper. It is also stated that *Apis dorsata* could not be domesticated, but would run wild all over the country; but from all the information we can gather we have no fear of any of these things. The facts prove that they have not run out *Apis Indica, Apis florea,* and other Eastern bees in their own habitats; furthermore, it is doubtful whether they would be able to stand our changing climate, even in the South; for it must be understood that India and the Philippines have a much warmer climate than our Southern States.

*HOW BEES GROW.**

Having devoted so much space to the different races of bees, it is now in order to discuss *how* they grow.

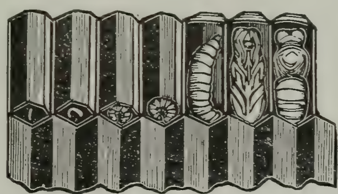
During warm weather, while bees are gathering honey, open your hive about noon, and put in the center a frame containing a sheet of foundation; examine it every morning, noon, and evening, until you can see eggs in the cells. By inserting it between two combs already containing brood you will very likely find eggs in the cells the next day.

If you have never seen an egg that is to produce a bee, you may have to look very sharp the first time, for they are white like polished ivory, and scarcely larger than one of the periods in this print. They will be seen in the center of the cells attached to the comb by one end. The egg under the miscroscope much resembles the cut. It is covered, as you notice, with a sort of lace-like penciling, or net-work it might properly be called. Immediately on discovering eggs, mark down the date. If the weather is favorable, these eggs will hatch out in about three days or a little more, when, in place of the egg, you will, if you look sharp enough, see a tiny white worm or grub floating in a minute drop of milky fluid. If you watch you will find bees incessantly poking their heads into these cells; and very likely the milky fluid is placed on and about the egg a little before the inmate breaks its way out of the shell. We infer this, because we have never been able to get the eggs to hatch when taken away from the bees,* although we have carefully kept



A queen's egg under the microscope.

the temperature at the same point as in the hive. The net-work, as shown in the cut above, allows the milky fluid to penetrate the shell of the egg to furnish nourishment for the young bee at just the time required. These worms are really young bees in their larval state, and we shall in future call them larvæ. They thrive and grow very rapidly on their bread-and-milk diet, as you can see if you look at them very often. They will more than double in size in a single half-day. This seems almost incredible; but there they are, right before our



The daily growth of larvae.

eyes. We presume it is owing to the highly concentrated nature of this "bread-and-milk" food that the workers are so constantly giving them that they grow so rapidly. If you take the comb away from the bees for a little while you will see the larvæ opening their mouths to be fed, like a nest of young birds, for all the world.

* See also DEVELOPMENT OF BEES.

* Since this was written it has been proven that eggs, removed from the hive, when subjected to proper temperature will hatch if supplied artificially with the milky food, otherwise not.

Figures under the cut represent the age in days from the laying of an egg. First the larva just having broken the egg-shell on the third day; next, a larva on the fourth day. During the fifth and sixth days they grow very rapidly, but it is difficult to fix any precise mark in regard to size. On the ninth day, the larva, having straightened itself out, the worker-bees cap it over.* We have made a pretty accurate experiment on this point, and it was just six days and seven hours after the first egg hatched that the bees completely capped it over. To determine when larvæ begin to have legs and eyes, see DEVELOPMENT OF BEES; but we found that the wings develop toward the last of the growth.

Regarding this point, Frank Cheshire, in his work on "Bees and Beekeeping," says:

The chorion of the egg breaks, usually after three days (the time varies according to temperature), and a footless larva, with thirteen segments, exclusive of the head, alternately straightens and bends its body to free itself of the envelope. It is extremely curious that, before hatching, the larva presents rudimentary legs, which disappear—a fact which some have suposed to indicate "atavism," a reference to an ancestral type in which the larva bore feet; but this does not seem to be valid, for reasons which would encroach too much on our space. Toward the end of the larval period, the three segments following the head have little scales beneath the skin on the ventral side, which are the beginnings of the legs, and which can not be seen until the creature has been immersed in alcohol; the budding wings outside these, on second and third segments, are, by the same treatment, brought under view, as are also the rudiments of the sting in queen or worker larvæ, the male organs appearing in that of the drone. After sealing, the fourth segment begins to contract, and the fifth becomes partly atrophied, so that, soon, the former constitutes only a partial cover for the base of the developing thorax, and the petiole between it and the abdomen, while the latter becomes the narrow first abdominal segment. It has been explained that the last three segments disappear in forming the sting; and now we find the fourth forming the petiole, leaving nine of the thirteen original segments, of which three go to the thorax and six to the abdomen.

After the larvæ are 6 days old, or between 9 and 10 days from the time the egg was laid, you will find the bees sealing up some of the largest. This sealing is done with a sort of paper-like substance in which we find wax shreds, old silk, bee hair, and sometimes pollen; and while it shuts the young bee up, it still allows it a chance to breathe through the pores of the capping. It is given its last food, and the nurses seem to say, "There! you have been fed enough; spin your cocoon, and take care of yourself."

After this, as a general thing, the young bee is left covered up until it gnaws off the capping and comes out a perfect bee. This will be in about 21 days from the time the egg was laid, or it may be 20 if the weather is very favorable; therefore it is shut up 11 or 12 days. Now, there is an exception to this last statement, and it has caused not a little trouble and solicitude to beginners. During very warm summer weather, the bees, for one reason or another, decide to let a part of their children go "bareheaded," and therefore we find, on opening a hive, whole patches of immature bees looking like silent corpses with their white heads in tiers just about on a level with the surface of the comb.* At this stage of growth they are motionless, of course, and so the young beekeeper sends a postal card, telling us the brood in his hive is all dead. Some have imagined that the extractor killed them, others that it was *foul brood;* and we often think, when reading these letters, of the family which moved from the city into the country. When their beans began to come up, they thought the poor things had made a mistake by coming up wrong end first; so they pulled them all up, and replanted them with the bean part in the ground, leaving the proper roots sprawling in the air. We can rest assured that the bees almost al-

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* Soon after the cell is sealed the larva begins spinning. Slowly the head swings from side to side, and as the work progresses the body bends, retracts, advances, and finally doubles on itself until the larva lies reversed in the cell. The work proceeds in a most aimless sort of way, and yet before it ceases the cell is completely coated. A strong magnifying glass fails to reveal the threads, and all that can be seen is a thin brown film resembling a varnish. It requires a microscope to see the threads. Presumably the larva continues its spinning until no uncovered surface is encountered. Why it never remains with head to the rear of the cell is another mystery, but it is reasonable to believe that it is so simple a matter as turning toward the air.

With the queen larva the procedure is the same except that the upper portion and base of the cell is not covered with the cocoon, as the larva can not climb to it, and spins only as far as she can reach. After spinning, the larva turns on its back and lies motionless as far as the eye can detect. Very slowly the transformation takes place until there appears in place of the larva a bee, bluish-white and perfectly still. A close scrutiny will show the wings folded down against the thorax and between the first and second pair of legs. They are folded in a little white case, and look more the shape of one's thumb than a pair of wings.

The first sign of color appears at the tips of the antennæ, then the eyes and feet begin to color, and it gradually spreads until the whole bee is colored. Soon a slight trembling, a twitching of antennæ, or a foot or leg is noticeable, the movements extend and increase, and the encased wings are seen to be moving. Slowly they move around until they are under the bee as it lies on its back, and then unfold. When this occurs the bee turns over and begins to cut its way out.—A. C. M.

* This seems to be peculiar of the offspring of some queens or strains, and is sometimes so pronounced that almost no brood is perfectly sealed at any season.—A. C. M.

ways know when it is safe to let the children's heads go uncovered.

It is very important, many times, to discover just when a queen was lost or a colony swarmed; hence you should learn these data thoroughly: The development of a bee occupies 3 days in the egg, 6 in the larval state, and 12 days sealed up.

The capping of worker-brood is nearly flat; that of the drones so much raised or convexed that we can at a glance tell when drones are reared in worker-cells, as is sometimes the case.

The young bee, when it gnaws its way out of the cell, commences to rub its own nose, straighten out its feathers, and then push its way among the busy throng, doubtless rejoicing to become one of that vast commonwealth. Nobody says a word, nor, apparently, takes any notice of the youngster; but for all that, they, as a whole, we are well convinced, feel encouraged, and rejoice in their own way at a house full of young folks. Keep a colony without young bees for a time and you will see a new energy infused into all hands just as soon as young bees begin to gnaw out.

If you vary your experiment by putting a frame of Italian eggs into a colony of common bees, you will be better able to follow the newly emerged young bee as it matures. The first day it does little but crawl around; but about the next day it will be found dipping greedily into the cells of unsealed honey, and so on for a week or more. After about the first day it will also begin to look after the wants of the unsealed larvæ, and very soon assists in furnishing the milky food for them. While so doing, a large amount of pollen is used, and it is supposed that this larval food is pollen and honey, partially digested by these young nurses. Bees of this age or a little older supply royal jelly for the queen-cells, which is the same, probably, as the food given very small larvæ. Just before they are sealed up, larvæ to produce worker-bees and drones are fed on a coarser, less perfectly digested mixture of honey and pollen.* Young bees have a white downy look until they are a full week old, and continue a peculiar young aspect until they are quite two weeks old. At about this latter age they are generally active comb-builders of the hive. When a week or ten days old they take their first flight out of doors; we know no prettier sight in the apiary than a host of young Italians taking a playspell in the open air, in front of their hive. Their antics and gambols remind one of a lot of young lambs at play.

* More probably the only difference is the addition of honey with its contained pollen, to the food previously given by some other nurses, perhaps younger ones.—A. C. M.

It is also very interesting to see these little chaps bringing their first load of pollen from the fields. If there are plenty of other bees in the hive of the proper age, they will not usually take up this work until about two weeks old. The first load of pollen is to a young bee just about what the first pair of pants is to a boy-baby. Instead of going straight into the hive with its load, as the veterans do, a vast amount of circling round the entrance must be done; and even after the young bee has once alighted it takes wing again before rushing all through the hive, to jostle nurses, drones, and perhaps the queen too; saying as plainly as could words, "Look! Here am I. I gathered this, all myself. Is it not nice?"

We might imagine some old veteran, who had brought thousands of such loads, answering gruffly, "Well, suppose you did; what of it? You had better put it in a cell and start off after more, instead of making all this row and wasting time, when there are so many mouths to feed." We said we might imagine this, for we have never been able to find any indication of unkindness inside a beehive. No one scolds or finds fault, and the children are never forced to work, unless they wish. If they are improvident, and starvation comes, they all suffer alike, and, we do believe, without a single bit of hard feeling or censure toward any one. They all work together, just as your right hand assists your left; and if we would understand the economy of the beehive, it were well to bear this point in mind.

Shortly following the impulse for pollen-collecting, comes that for honey-gathering; and the bee is probably in its prime as a worker when a month old. At this age it can, like a man of forty, "turn its hand" to almost any domestic duty; but if the hive is well supplied with workers of all ages, it now probably does most effective service in the fields. See Age of Bees.

When a colony is formed of young bees entirely, they will sometimes go out into

the fields for pollen when but five or six days old. Also when a colony is formed wholly of adult bees they can build comb, feed the larvæ, construct queen-cells, and perform work generally that is usually done by younger bees; yet it is probably better economy to have bees of all ages in the hive.

BEES ATTACKING(?) FRUIT.—Occasionally we hear complaints of how bees will attack and eat up fruit; and to a casual observer, at least, they apparently do bite through the skin, extract the juices, until the specimen is shriveled up to a mere semblance of its former shape and size. Careful investigation has shown repeatedly that bees never attack sound fruit no matter how soft the skin nor how juicy and pulpy the contents within the skin.

Some years ago, Prof. N. W. McLain, then in the employ of the Department of Agriculture, Washington, D. C., conducted an elaborate series of experiments in which he placed sound fruit, consisting of grapes, peaches, apricots, and the like, in hives containing bees that were brought to the verge of starvation. This fruit was left in the hives day after day, but it was never once molested. Then he tried breaking some of the fruit, and in every case all such specimens were attacked by the bees sucking up the juices until nothing but a dried skin and the stones or seeds were left.

Years later, Prof. H. A. Surface, economic zoologist at Harrisburg, Pa., tried a similar experiment, but in no case did the bees attack the sound fruit, although they partook freely of that which he had broken.

At the Wilmington State Fair, held Sept., 1908, in Delaware, Mr. Joel Gilfillan, of Newark, Del., had on exhibition a three-story observation hive containing two combs of bees. In the third story was hung a peach, a pear, and a bunch of grapes. This was kept on exhibition during the entire fair where the general public could see it. As is shown, this fruit was never once visited by the bees. The general verdict of those who saw it, fruit-men and farmers alike, was that bees could not injure *sound* fruit.

The authors have had, during the past thirty years, between three and four hundred colonies located in a vineyard at their home apiary. Notwithstanding hundreds and hundreds of pounds of grapes are raised every year, the bunches hanging within three or four feet of the entrance of the hives, the sound fruit is never attacked; but during a dearth of honey, a broken or otherwise bruised bunch of grapes will often be visited by a few bees.

The writer of this article has attended various horticultural and pomological conventions, both State and national. Among the progressive fruit-growers and horticulturists there is a general acknowledgment that bees do not attack sound fruit; that the little harm they do to damaged fruit is compensated for a hundred times over by the indispensable service they perform in pollinating fruit-blossoms early in the season when no other insects or means of mingling the pollen exists. Indeed, some of our best fruit-growers are now keeping a few hives of bees in each of their orchards. Often they invite beekeepers to locate yards of bees either in the orchards or as near as it is practicable to put them.

Grapes punctured by birds and despoiled by bees.

But a casual observer might easily get the impression that bees not only suck damaged fruit dry, but actually puncture and eat up sound fruit. Some years ago a neighbor sent word to us that he would like to have us come up to his vineyard and he would give us indisputable proof that our bees were actually puncturing his grapes and sucking out the juice. We looked at the luscious bunches as they were hanging down, and, sure enough, there were small needlelike holes in almost every berry that the bees were working on. It

looked like a clear case of "caught in the act" evidence against them. For the time being we were unable to offer a satisfactory explanation. We brought the matter to the attention of an old farmer who had been a beekeeper for many years. Finally one morning he sent word to us that he had found the guilty culprit, and that if we would come down to his place *early* some morning he would point him out. This we did. He showed us a little bird, quick of

One of the exhibits of bees at the Grange Fair, in Wilmington, Delaware, held in September, 1908. A card in the hive read, "Bees do not injure sound fruit."

flight, and almost never to be seen around the vines when any human being was present. This bird, about the size of a sparrow, striped, and called the Cape May warbler *(Dendroica tigrina)*, has a long sharp needlelike beak. It will alight on a bunch, and, about as fast as one can count the grapes, will puncture berry after berry. After his birdship has done his mischief he leaves, and then come the innocent bees during the later hours of the day and finish up the work of destruction by sucking the juices and the pulp of the berry until it becomes a withered skin over a few seeds. It is thus the birds during the early hours of the day are never seen; but the bees, coming on later, receive all the credit for the mischief. The Cape May warbler is not the only bird guilty of puncturing grapes. There are many other species of small birds that learn this habit, and among them we may name the ever present sparrow and the beautiful Baltimore oriole, the sweet singer that is sometimes called the swinging bird, from its habit of building its nest on some overhanging limb.

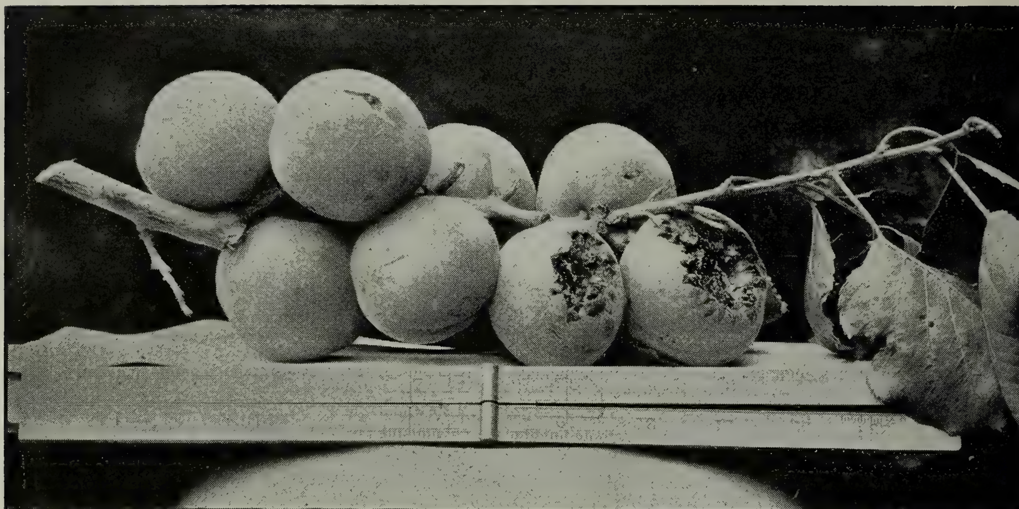
For further information regarding grape-puncturing birds, refer to bulletins by Dr. Merriam, of the United States Department of Agriculture, Washington, D. C.

WHEN BEES MAY DAMAGE FRUIT.

But there are times when bees do a real damage; and it is then that their owner should compromise; or, better still, seek means to avoid trouble in the first place. In the fruit-drying ranches of California, apricots and peaches are cut up into small pieces and laid upon trays exposed to the sun's rays. If there is a dearth of honey at this time, and a large number of bees in the locality, this fruit is quite liable to be attacked. The bees may visit it in such large numbers that they suck out the juices, leaving nothing but the shriveled form of the fruit. The property is, of course, damaged and its sale ruined. Before any thing of this kind can happen, the beekeeper should move his whole yard to a point three or four miles distant from any fruit-drying operations. Failing to do so the fruit-grower, if the bees caused trouble, might enter suit for damages, and possibly recover the value of his crop.

Years ago we had trouble with a cider-maker. He claimed that our bees would lick up the cider from the press as fast as he could make it. We easily adjusted this difficulty by screening his building with mosquito netting.

In every case of this sort the owner of bees should avoid trouble. If he is a member of the National Beekeepers' Association he might put up a stiff defense, it is true; but in the case of the fruit-drying ranches and the cider-mills, the beekeeper had better err on the safe side by avoiding suit for damages, because no beekeepers' union nor any other organization, nor lawyers either, for that matter, would be able to give much assistance where it was clearly proven that the bees were doing an actual damage.



Apricots damaged by birds; fruits thus injured are sucked dry by bees, which store the juice as honey.

BEES EXONERATED BY A JURY.

In 1900, trouble arose between two brothers named Utter, at Amity, N. Y. One was a beekeeper and the other a fruit-grower. The latter averred that the former's bees punctured his peaches, and that, in consequence of their alleged damage, he claimed he was unable to raise any fruit. There had not been very good feeling between the brothers for years. The fruit-grower brought suit against the beekeeper, and the case was tried on December 17, 18, and 19, 1899, at Goshen. There was no lack of legal talent on either side. The case was a very hard-fought one from beginning to end. Among some thirty odd witnesses examined, the Government expert, Mr. Frank Benton, formerly of the United States Department of Agriculture, Washington, D. C., gave his testimony to the effect that bees never puncture sound fruit; that it is practically impossible for them to do so, owing to the fact that they have no cutting jaws like those found in the wasp and other insects of that character. He also showed how wasps and birds will, under some conditions, puncture fruit; that these minute holes they make will, during a dearth of honey, be visited by bees. Other expert testimony was offered, nearly all of which exonerated the bees. After all the evidence was in and the pleas were made, the jury returned a verdict for the defendant.

For further particulars regarding this, the reader is referred to the Secretary of the National Beekeepers' Association.

In case trouble arises, the owner of the bees will do well to read BEES AS A NUISANCE, and also the other subject found in its alphabetical order, LAWS RELATING TO BEES.

BEEKEEPING AND FRUIT-GROWING.—Under FRUIT-BLOSSOMS and also under POLLEN we have shown the very intimate relations between the beekeeping industry and the business of growing fruit. Most fruit, especially the finer varieties, requires the aid of the bees in scattering pollen from flower to flower when the fruit is in embryo or just started. If, therefore, the two industries are so intimately connected, why should not the business of growing fruit combine nicely with the business of producing honey? Fruit-growers all over the country have come to recognize the valuable work performed by the bees. As they consider their little friends indispensable, they have been buying one lot of bees after another, until now a number of the fruit-growers have quite large apiaries; and, while they were induced to put in bees to help out their fruit-growing, they also found the bee business was a very profitable side line to run in connection with fruit-growing. It is very seldom that the two industries conflict. The result is, that one man or a force of men can work the bees a part of the time and the fruit trees the other part. We know of a large number of orange-growers who are also at the same time quite extensive beekeepers.

Bees and chickens in the same back lot, Detroit, Mich.

There are also a number of fruit-growers, both in Wisconsin and New York, who keep a good many colonies of bees. They are, therefore, able to furnish two of the finest sweets in the world—the sugar in fruit and the natural sugar as we find it in the nectar of the blossoms themselves.

Under the head of BEES AND POULTRY we also show how nicely the keeping of bees goes with the care of chickens.

But the purpose of this article is not to show that bees and fruit go nicely together, but rather to show that bees are not a nuisance, as is claimed by some fruit-growers.

See FRUIT BLOSSOMS, also POLLEN for a further discussion of the relation of bees to fruit.

BEES AND POULTRY.—Under the head of BEES AND FRUIT we show how beekeeping and fruit-growing go well together. If there is any industry, aside from that of growing fruit, that combines nicely with the keeping of bees, it is poultry. When the bees require the most attention, the poultry needs the least. When chickens demand the most time, the bees are taking their long winter sleep, and, of course, require no attention, or very little. In the more northern States, at least, the bees are put into winter quarters along in the fall, and require almost no attention until the following spring, along in April or May. During this time the chickens require considerable care. If one would have early broilers in the spring, he must start his incubator going early. He must feed his chickens so that they will lay during the winter, and not only that, but give him fertile eggs so that he can start his incubator. Incubator work and the brooding of chickens go on along until spring. The bees at that time require a little attention in the way of feeding and going over to see whether any of them need uniting; but, beyond that, they will not require very much care until about the middle of May or the first of June. In the mean time, the cleaning-out of the poultry-houses, gathering of eggs, marketing of the same, all require considerable time on the part of the owner of the chickens. Just about the time the bees begin to require considerable attention the hens will begin to lessen their laying, and the weather will be such that they will not require such careful feeding; for usually they can get a good deal of their green food directly from the ground. At

that time the beekeeper will begin either extracting or putting on his comb-honey supers. If the chickens require a good deal of his time then, he can simply put on extra supers, piling them one on top of the other, until he has the hives stacked up three or four stories high. If he practices artificial swarming, as described under that head, he will not have much trouble with swarms. He can even go further, and prevent swarms from coming out to a very great extent by practicing the method given under head of SWARMING and ARTIFICIAL SWARMING. Taking it all in all, he can postpone the greater part of his bee work until his chickens do not require very much attention, and then he can take off his honey, scrape his sections, or extract if necessary.

The great majority of those who keep bees in the United States work them in connection with some profession or some other industry, like fruit-growing or poultry-keeping. The average locality does not make it feasible to make beekeeping the sole means of livelihood. While it is true there are a great many specialists located in various parts of the country, they are in localities that are particularly favorable for the keeping of bees. One can scarcely make a living from one or two hundred colonies; but that number in connection with poultry-keeping or the growing of fruit helps to make up the general income of the family. For a further consideration of the question whether bees can be made the sole means of livelihood, see PROFITS IN BEES.

BEES AND TRUCK GARDENING.—Beekeeping can be managed in connection with truck gardening, but it does not make nearly as good a combination as bees and poultry. The difficulty in combining bees with gardening is that the latter requires its greatest attention when the bees also need a large amount of care. There are times and circumstances, however, when beekeeping, fruit-growing, and poultry-keeping might all three be worked together; but in most cases we fear it would be a great deal like the old adage, "Jack of all trades and master of none."

BEES AS A NUISANCE.—It would seem almost out of place to discuss this question in a work intended for perusal and study by those who believe (and rightly, too) that bees are not a nuisance; but, as we shall show, there are very good reasons why we should calmly discuss this question in order to avoid trouble that may arise in the future. Certain difficulties have arisen between the keepers of bees and their neighbors. Perhaps the bees, after a long winter confinement, have taken a flight and soiled the washing hung on a line in a neighbor's yard, or after several days' confinement at any time, if the clothes are within a short distance. Possibly some of his children have been stung, or there have been times when he has been annoyed while in the peaceable possession of his own property by bees coming on his premises, and smelling around, as they sometimes do during the fruit-canning season when the aroma of sugar and juicy fruits is flowing out through the doors and windows of the kitchen. Possibly the offended neighbor keeps chickens, and members of his feathered tribe have trespassed on the grounds of the beekeeper. The result of all this is that bad feelings arise. Complaint is made to the village fathers; an ordinance is passed declaring bees within the limits of the corporation to be a nuisance, and requiring the keeper to remove them at once or suffer the penalty of fine or imprisonment, or both.

In some instances, live stock has been stung; a cow or a calf or a horse may get near the entrances of the hives, which, we will say, are within a foot of a dividing line between the two properties. Perhaps the stock is stung nearly to death. Damage is claimed and a lawsuit follows, with the result that a feeling of resentment is stirred up against the beekeeper. But this is not all. Possibly the beekeeper has an apiary in his front yard, bordering on the general highway. A nucleus may be robbed out, with the result that the bees go on the warpath, and begin to sting passersby. Perhaps a span of horses is attacked; a runaway follows; damages are claimed, and another lawsuit is begun.

In the foregoing we have supposed *possible* instances. It is proper to state that they are only types of what has occurred and may occur again, so it behooves us to be careful.

In the first case mentioned (the aggrieved neighbor's washing soiled by the stains from bees affected with dysentery), it is well for the beekeeper to send over several nice

sections of honey, or to offer to pay for the damage done to the washing. Nothing makes a woman more angry than to have her nice clean white linen, after she has scrubbed, rinsed, and hung it out to dry, daubted with nasty, ill-smelling brown stains. But if our beekeeping friend will take pains to offer an apology *before* the woman makes complaint, and shows a disposition to make the matter good, trouble will in most cases be averted. And right here it should be said, if the bees are in the cellar do not set them out on a wash-day; or if they are outdoors, and the sun comes out bright so they begin to fly strongly from the hives, send word to your neighbors and ask them not to hang out their washing, if it is a wash-day, for a few hours. Send along a few boxes of honey, and keep the folks across the way "sweetened up." Ninety-nine neighbors out a hundred will put up with a great deal of inconvenience, and say, "Oh! that is all right. It won't take long to rinse out the clothes again."

Take, for example, more serious cases—where horses or cattle have been stung. If you have been foolish enough to place hives near the highway or your neighbor's line fence where he has loose stock, you may have to pay pretty dearly for it before you get through. The remedy is prevention. Always put bees in a back yard, and not too close to your neighbor's line fence. Be careful, also, to prevent robbing. See that there are no weak nuclei with entrances too large. As soon as the honey-flow stops, contract the entrances of all the weaker colonies. If extracting is done after the honey-flow, great caution needs to be exercised. The extracting-room should be screened off, and bee escapes provided. Whenever possible, take off all surplus by the use of bee escapes rather than by shaking. See Robbing and Extracting.

Scheme for protecting horses while cultivating a field next to a bee-yard.

WHAT TO DO WHEN BEES ATTACK NEIGHBORS' HORSES.

But it sometimes happens that something must be done at once to avert an attack upon teams or horses working in fields adjoining a bee-yard We have one out-yard located near a field where our neighbor's horses have been attacked by the bees on several occasions. We supplied our neighbor with clover seed for this field; and when he came to cut the crop the horses would occasionally be stung while drawing the mower. In one case there came very near being a serious mixup, as the team nearly ran away with the mowing-machine.

Two years later corn was planted in this same field. When the horses were cultivating up and down the rows they were at-

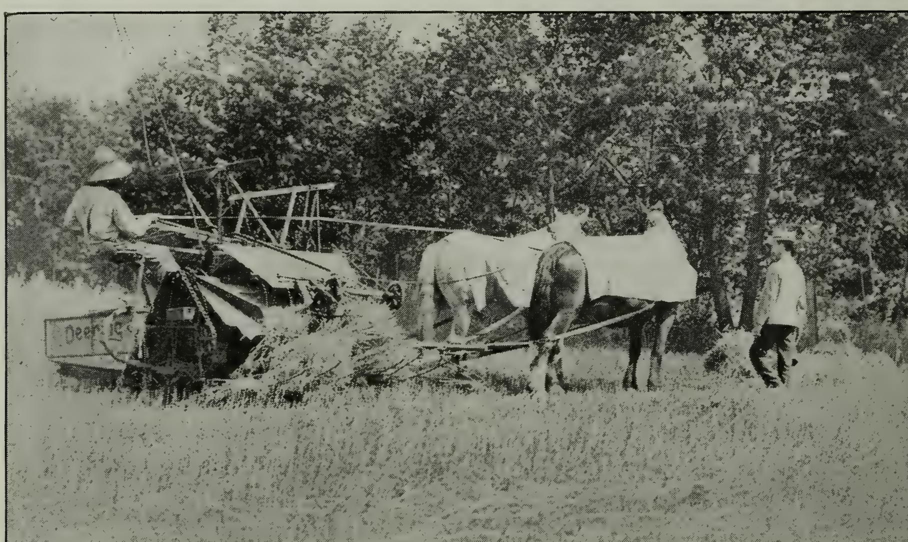
tacked again by the bees, for they were going in great droves across this field to a patch of clover beyond. Notwithstanding we had a high board fence to raise the flight of the bees above the team when near our yard, there was more or less trouble. On one occasion the driver was stung pretty severely, and the animals became unmanageable. Fortunately the driver got them under control without any serious consequences.

Now, our neighbor is a kindly man; and when he telephoned what had happened we saw that something would have to be done. We told him to go to the harness-shop and secure some large horse-blankets that would cover the necks and backs of the horses, and we would pay the bill. We then directed him to secure some large squares of mosquito netting and fold this around the horses' heads. In the meantime we supplied him with veils for himself and man.

When the next day came for cultivating, the blankets were put on and we went down to watch developments. We found that the blankets helped very materially, as they protected the animals from the onslaught of bees around their backs and necks where they could not brush or switch them off. Our neighbor did not think it was necessary to put the mosquito netting over their heads, as he said his horses did not mind bees on the face, as they could be brushed off on the fore-legs. With these large blankets the horses went up and down the rows with very little trouble.

We found upon investigation that the bees were not disposed to be cross, but in going to and from the fields in search of honey they were interrupted in their flight. The switching of the tails of the horses angered them with the result as stated.

In cases of this kind we find it an advantage to have an experienced beeman, and also an experienced horseman, if the two can be combined in one person. We happened to have just such a man in our employ, and sent him along around with the mower and reaper with a lighted smoker. If he found the bees were flying around the horses' heads he used a little smoke and drove them away. It was not necessary for him to follow the machine clear around the field, but only along that side next to the flight of the bees.



When the team was in the flight of the bees the smoker was held in readiness should the horses be stung.

But suppose your neighbor is unreasonable and ugly, and he brings suit for damages; or suppose that your bees are located in a city or village, and that the town council has declared your bees a nuisance.

Do not move the bees if you have used reasonable precaution, but write at once to the Secretary of the National Beekeepers' Association, whose address will be found by writing to any bee-journal or the publishers of this work. If you are a member of the Association you will be entitled to protection, and possibly all or a part of the

court expenses will be paid by the organization; but the Association does not undertake to defend its members against criminal carelessness of such a kind as we have already described. When the beekeeper has exercised every precaution, then it endeavors to protect his rights. This means that you should become a member *before* you get into trouble. The annual fee for membership and protection is $1.50.

Well, we will say the attorneys have been retained, and the Association is back of you. Any number of decisions have been handed down to prove that bees are not a nuisance *per se;* that, when they are properly kept, and due precautions are used, they can not be driven out of the corporation. There are several precedents from various courts, even from the Supreme Court of Arkansas, to show that bees have the right to be kept within a corporation like any live stock, so that any ordinance not in conformity with these decisions can be declared unconstitutional. Several ordinances declaring bees to be a nuisance have been repealed. See LAWS RELATING TO BEES.

BEES, CROSS.—See ANGER OF BEES.

BEES, CROSSES OF. —See HYBRIDS.

BEES, HANDLING.—See FRAMES, MANIPULATING; also EXHIBITS.

BEES ON SHARES.—In some localities, notably in California, Colorado, and the great West, bees are often kept on shares. While this method of doing business has usually been conducted quite successfully and satisfactorily to both parties, yet nevertheless many disputes and troubles have arisen, perhaps because there was a lack of contract; or if there was one there was nothing in it to cover the point in dispute.

The following form of contract was very carefully drawn by an attorney, and it is hoped it will meet every condition.

ARTICLES OF AGREEMENT.

This agreement, made and entered into at——, this —— day of ——, 19—, by and between —— of ——, party of the first part, and hereinafter called the owner, and ——, of ——, party of the second part, and hereinafter called the employee.

Witnesseth: First, that said owner has agreed, and in consideration of the covenants and agreements herein contained and to be performed by said employee, does hereby agree to provide a good location for keeping bees, at or near ——, and furnish and put thereon, on or before the —— day of ——, 19— not less than —— colonies of healthy bees, and then and thereafter at such times as needed during the continuance of this contract, to provide and furnish at his own cost and expense, all hives, tools, implements, machinery, and buildings necessary to enable said employee to carry on successfully the business of producing and securing honey and wax from said bees; and further to pay one-half of the cost and expense of all sections, cans, bottles, shipping cases, and packages that may be required to put the honey and wax into marketable shape; and in case it shall be necessary to feed said bees, to provide and furnish feeders and the sugar for making the syrup; and said owner further agrees to give and deliver on the said premises, to said employee, as and for his compensation for labor done and provided by him in caring for said bees and securing honey and wax, the full one-half of all marketable honey and wax produced and secured from said bees.

Second: In consideration of the above covenants and agreements, the said ——, employee, hereby agrees to enter the employ of said owner on said —— day of ——, 19—, and at once care for said bees in a proper manner; do, perform, and provide all labor necessary to carry on successfully the business of producing and securing honey and wax ready for market; pay one-half the cost and expense of all sections, cans, bottles, shipping cases, and packages that may be required to put the honey and wax into marketable shape; feed the bees, when necessary that they shall be fed, and deliver on the premises to the said owner the full one-half of all the marketable honey and wax produced and secured from said bees, and to accept the remaining half as and for his full compensation for labor done and provided by him in the care of said bees and the production and securing of honey and wax.

Provided, and it is mutually agreed and understood by and between the parties hereto, that said employee shall double up all of said hives at the close of the season or leave them reasonably strong and well supplied with stores and prepared for the winter; and if any of said colonies of bees are lost through the carelessness or negligence of said employee, said owner may recover from said employee as damages an amount not greater than one-half what it would cost to replace said bees and queens; all increase of swarms (artificial or natural) to belong to said owner. It is further mutually agreed and understood that in case no honey is secured, or the amount runs below ten (10) pounds per colony, said owners shall pay to said employee, as and for his compensation for all labor done and provided by him on and about said bees, an amount not exceeding —— cents per hour for each and every hour of labor so done, and provided by said employee on and about said bees, and in such case all honey to belong to said owner.

Signed in duplicate by said parties, the day and year first above written.

Signed in presence of —— ——

—— —— —— ——

—— ——

The foregoing comprises the essential features of a contract; but local conditions may render it necessary to make some modifications.

The last clause in the contract is inserted as a matter of fairness to the employee. If no honey should be secured, he has performed his part of the contract in good faith, and, moreover, has improved the apiary—perhaps increased it—so that it will be in better condition the following year for a honey crop. For this better-

ment it is no more than right that the owner should pay his man a reasonable sum, whatever amount may be agreed on; or, if preferred, a certain number of colonies. One can readily see that, in case the honey season was an absolute failure, the employee would suffer a total loss except for a provision of this kind, and that the owner would still have his bees, his implements, and every thing necessary to carry on the business for another season.

By the above contract it is to the interest of both parties to keep down increase. The employee must know, if he is a practical beekeeper, that, the greater the increase, the less the honey; and he will, therefore, bend all his efforts and skill to keep the colonies in the best condition to obtain a crop of honey.

Keeping bees on shares is practiced quite extensively in Colorado and California. It very often happens that a beekeeper lately arrived from the East desires to try a locality to determine whether it will be suited to his health, and whether or not he can make the keeping of bees a success. He accordingly finds a beekeeper whose other business leads him to desire some one competent to manage them for him. But where one is well settled in a locality, and has the means whereby he can purchase the bees, he should do so—better even go in debt; but in this case, to secure the owner we would agree that, in case the honey crop is insufficient to pay for at least half the bees, he will then agree to content himself with half the honey crop on the terms here proposed.

BEES, STINGLESS.—The bees of the Western Hemisphere are stingless—at least a very large proportion of them. Their habitat extends from the boundary between the United States and Mexico down to Buenos Aires in Argentina, embracing an area of 8,000,000 square miles. One comparatively unimportant species inhabits most of the West India islands. There are a few species in Asia and Africa.

By entomologists these bees are usually classed under two great genera—*Melipona* and *Trigona;* but some naturalists are disposed to add another, *Tetrasoma.* There is an extraordinary variety of these bees, which is supposed to embrace at least 100 species, whereas there are not more than 8 species of *Apis.* The variation in size is also great, for some are no larger than a mosquito, while others are considerably larger than the hive bee. A number of naturalists are at work studying them with a view to their proper classification and arrangement by species.

There is an equal variation in the number of bees per colony, for some consist of only a few (100) individuals while others are supposed to contain not less than 100,000 bees.

Some build only small nests, not much larger than an orange; others, again, construct a home as large as an ordinary flour-barrel. Some build in a hole in the ground; others in the open air, as wasps and hornets do, while quite a number build their nests in the hollows of forest-trees.

An intermediate species occupies the position midway between bees and wasps, and is generally spoken of as the honey-gathering wasp. Wasps are carnivorous, hence it is hardly fair to class this one with these hawks of the insect tribe.

Early travelers in South and Central America did not fail to notice the stingless bees, and they are quite frequently referred to by them. Capt. Basil Hall, in the 18th century, noticed apiaries of them in Peru; and Koster, in his Travels in Brazil, carefully mentions them. Spanish writers on Central America casually noted them in the 16th century; but no European seems to have been interested enough in them to make a comprehensive study of their life-history and habits. The work was left for the twentieth-century naturalists. Geoffrey St. Hilaire, a naturalist-explorer, did something to awaken interest by his now classical observations on honey-gathering wasps of Paraguay, of which he furnished a complete account in 1825 (Paris). Azara, a similar explorer, also called attention to them in his travel through Paraguay. He describes a species twice as large as *Apis mellifica.*

Other explorers have mentioned them from time to time, but nothing of real value was elicited until lately. Their study has now been taken up in earnest. White men have been inclined to dismiss them as worthless for practical purposes; but the natives of South America are certainly not of that opinion. On the contrary, they regard them as superior to the "stinging

fly" of the white man. In Southern Mexico, Central America, and South America, they are quite frequently kept in a domesticated state by the native inhabitants—that is to say, they have them in hollow logs which have been brought from the forests. These "hives" are generally hung up by ropes around their dwellings to protect the bees from their chief enemy, the lizard.

Stingless Worker Italian Worker Italian Queen
Magnified two times.

The logs are robbed at stated intervals, the keeper being well satisfied if he can secure a gallon of honey per hive at a robbing, depending somewhat on the species used for domestication.

Apparently no effort has ever been made to invent a hive suitable to their wants. It is noticeable that the natives use only those species whose homes are made in hollow

Italian Queen Stingless Queen
Magnified two times.

trees, no effort being made to utilize the many other species whose nests are made in holes in the ground or on tree-branches.

The quality of the honey and wax varies very much, some of it being quite good and some quite the opposite. The wax is apt to be mixed with propolis to a great extent; but at least one species inhabiting the upper tributaries of the Orinoco, in Colombia, furnishes a desirable wax which has been frequently sold in this country.

While the stingless bees can not sting they *bite* and worry in a way to surpass bees possessed of a sting. At the Philadelphia field-day meeting at which a thousand beekeepers were present, in June, 1906, two colonies of a large species of stingless bee were exhibited. A hive of them was torn apart and opened for inspection. Did those stingless bees take such intrusion without making any objections? Not at all. They attacked their despoilers in a way they will not soon forget. They would bite, grasp the hair, eye-lashes, twist and pull, and even crawl into the ears and noses of their tormentors. So vicious was their onslaught that they drove one man, who had a hand in breaking up their home, from the scene of action. While the pain of their bite is infinitessimal, yet the high-note hissing sound, getting into the hair, pulling at the eyes and eye-lashes, and crawling into the nostrils and ears, almost makes one crazy.

It is fair to state that stingless bess do not offer such attack unless provoked to fury; ordinarily they can be handled without any protection whatever.

BEE ESCAPES.—See Comb Honey, also Extracting.

BEGINNING WITH BEES.—The beginner will find he will be able to understand the articles in this work much more

Prof. H. A. Surface, Zoologist, at Harrisburg, Pa., with his beginners' class in beekeeping.

readily if he can in some way manage to visit a beekeeper in his vicinity. If he can afford it, it would be well for him even to go some distance to see some progressive beekeeper, and spend a whole day where he will be able to pick up tricks of the trade, and a fund of information that might take him weeks or months to dig out of text-books. Even if he knows of no one but an old-fashioned box-hive beekeeper, he should see him; but, far better, visit some practical man who will be able to point out the queen, and illustrate the *modus operandi* of opening a hive and handling the frames—in short, make a practical demonstration of many of the manipulations here explained. If there is no beekeeper he can visit he should send to his nearest dealer and get a one or two frame nucleus with a queen. Let him follow carefully the directions on the outside of the shipping box; then, with the bees before him, read and study his A B C's. Having seen the bees, and learned how to open a hive, what next?

We would strongly urge the importance of a small beginning with as little expense as possible; for nothing is more discouraging after having plunged into the business extensively (blindfolded as it were) than to lose a large portion of the bees, either through bad wintering or from some other cause—all for the want of a little practical experience, or even a theoretical knowledge. Many a person has met with disaster from starting out with bees on altogether too large a scale. Sometimes one is offered a bargain of 25 or 30 colonies including hives, bees, implements, smokers, etc., at a ridiculously low price, and the temptation becomes strong to buy. He'd better not unless he has read the several articles indicated in the fine print on the first page of this work.

After investing $25.00, put no more into the business until the bees bring in some returns. In other words, *make the bees pay* their way. It is a very easy matter to throw away some good money into the venture and get no returns; because beekeeping as a business is something that depends more upon the weather than perhaps any other. For this reason we do not advise any one to rely on bees as a sole means of livelihood. True it is that there are many beekeeping specialists; but they are men who have gradually grown into the

business, and as a general rule have an especially favorable location, keeping somewhere from 500 to 1000 colonies.

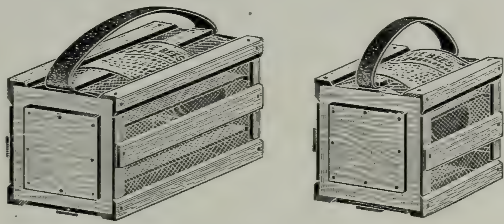
The keeping of bees is generally more successfully carried on in connection with some other business. Many a professional man desires some sort of light recreation, and a few bees will afford him just the diversion he needs. Farmers, fruit-growers, or horticulturists, may keep from 50 to 100 colonies without greatly interfering with any other work; and nearly every one, as explained under APIARY, can keep a few colonies in his back yard. Ten or twenty colonies will yield almost a certain return of a much larger revenue, per colony, than ten times that number. See PROFITS IN BEES, elsewhere.

Having considered some of the difficulties and uncertainties of beekeeping, one may now inquire whether he desires to go into the business at all. With the knowledge that from 10 to 20 colonies can usually be handled successfully, and at a good profit, the beginner will naturally desire to try his hand at it. How shall he make his start? Whenever possible, buy bees in your own vicinity. A strong colony of Italian bees, with tested queen, in a new Dovetailed hive, or in any modern hive, in fact, might be worth $10.00. If you buy of a dealer from a distance it will cost more. Usually bees that are hybrids or blacks, in movable-frame hives, second hand, sell from $3.00 to $5.00 per stock, including hive. If there are no modern beekeepers in the vicinity one may have to purchase a box hive or two with the combs all built solidly into the hive—see BOX HIVES. The price of these, if they are blacks or hybrids, is generally from $1.00 to $3.00 per hive.

To move colonies in box hives, turn the hive upside down, and tie over the end a piece of cheese-cloth. The moving should be done at night, or at least on a cool day, carrying them a distance of at least a mile and a half, otherwise many of the bees will return to their old location, unless they are much bumped and jounced in moving. See MOVING BEES.

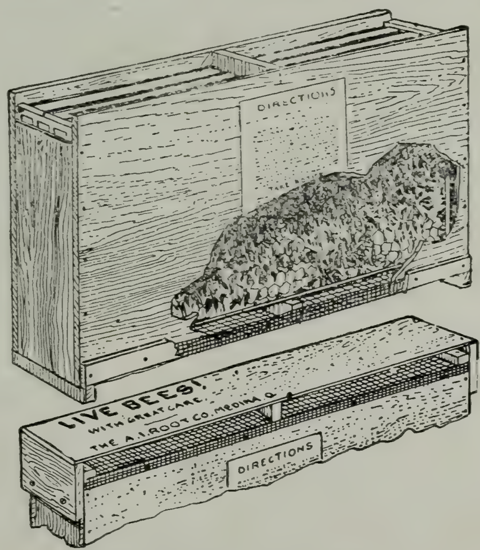
In some localities it may not be possible to buy bees of any one. Send to the nearest dealer for a half-pound or a pound of bees, or a one or two frame nucleus with a queen. If one doesn't mind expense, let him purchase four or five pound packages or nuclei and then proceed to build them up as described under NUCLEUS AND FEEDING.

On account of the danger of spreading bee disease we advise the purchase of bees in pound packages without combs. They come much cheaper this way, and the expense is very much less.



Pound and half-pound packages.

Before purchasing any bees he should get of his dealer or manufacturer five or ten modern hives in the flat. As there are several such hives on the market, all of them fairly good, the beginner may be at a loss to know which of them to choose. For comb honey we would recommend the Danzenbaker or Dovetailed hive. For particulars see HIVES. They are sold by all



Three-frame nucleus for shipping.

the dealers; and as these hives are used largely by expert beekeepers who carry on the business quite extensively with good results, the novice will not go far astray by adopting them.

As soon as the hives are received in the flat, nail them up and paint them. With every lot of hives there will be sufficient

nails of the right kind to put them together. If one can not afford to take the time himself, let him employ some carpenter, who, with the printed directions, will be able to put them together in a workmanlike manner. (A carpenter is not needed, however.)

Having the hives all in readiness, five or ten, as the case may be, one can, with his pound of bees or two or three nuclei, build them up by feeding, and then divide as recommended under NUCLEUS AND FEEDING.

If the beginner is successful thus far, he may then, with some assurance, purchase of his dealer one or two Italian queens, which he can easily introduce to the nuclei. See INTRODUCING. In dividing or forming nuclei, one should, of course, give the new queen he just purchased to the bees that are made queenless. After he has had a little more experience in watching and studying bees he may then be able to do something at queen-rearing. See QUEENS and QUEEN-REARING. To avoid trouble with robbers he should then read very carefully the subject of STINGS and ROBBING. Toward the close of the season he should next take up WINTERING, as found in its alphabetical order, reading this carefully; for more disasters in apiculture result from failure to winter bees properly than from any other cause.

BELLFLOWER.—See CAMPANULA.

BLACK BROOD.—See FOUL BROOD.

BLACK LOCUST.—See LOCUST.

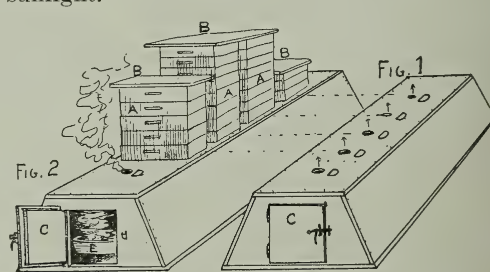
BLEACHING COMB HONEY.—Under head of COMB HONEY, and GRADING COMB HONEY, will be found something concerning the fact that a good many sections have soiled surfaces. This discoloration of cappings may go clear through, or it may be upon the surface itself. If the reader will look over the unsold odds and ends of the grocer's he will be able to find samples of all these classes, and the fall of the year is a good time to find them, as they are the last to sell.

A knowledge of how to make dark or soiled sections No. 1 white, thus putting them at the top of the market, may be worth hundreds of dollars to some beekeepers; and while it is probably not possible to make water-soaked and certain kinds of travel-stained sections white, there is a probability that a very large class of the soiled boxes can be rendered No. 1.

The late Byron Walker, a honey-merchant of Chicago, accidentally placed some yellow or pollen-stained sections in his show-window, where they were subjected to the direct rays of sunlight. A short time after, he noticed that the faces of these sections that were next to the light were bleached white, while those on the reverse side retained the old color. Instantly grasping at the suggestion he placed other sections of the same kind in the same window, and was gratified to learn that these were likewise bleached as were the first; but so far

White's bleaching-house for soiled comb honey.

as we know, Mr. Walker was successful in bleaching pollen-stained or yellow-faced combs only. The real travel-stained and water-soaked ones he considered beyond redemption. The time required to bleach the yellow sections was anywhere from two to three days, depending on weather and sunlight.



White's sulphur box for bleaching.

Mr. A. E. White, of Pala, California, apparently goes one step further; for in connection with sunlight he uses sulphur, which is known to be a powerful bleaching agent. His method is described as follows:

"We first fumigate with sulphur, then place the combs where the sun will shine on them, and that is the whole process.

"I build a frame on the south side of my honey-house, and cover the same with cotton cloth. A door opens from the honey-house into this room. I place shelves on the sides and ends of this room, the bottom shelf being a wide board to be used as a table. I place the combs on these shelves so that the sunlight will strike them. Dark combs will require several hours. This plan will whiten dark combs here in California. If you fumigate a few combs, then place them on a window-sill where the sun will shine on them, you will be convinced.

"In placing the sections on shelves in the morning, I find the following plan good: On the shelves at the east and west end of the room I place sections end to end lengthwise of the shelves, two rows on each shelf, one row on the outer and the other on the inner edge. The morning sun strikes one side, and the afternoon sun the other side. On the front shelves I set them crosswise of the shelf, far enough apart *so as not to shade each other.*

"I pack them away every evening; all not white I put out again next morning. Some of them will bleach quite slowly, but I have been able to whiten the worst ones by perseverance."

BOTTLING HONEY. Under BARRELS we have given some general directions on how to put up honey in wood so that it may be sent to market. Under EXTRACTED HONEY we have shown the styles of containers made of tin. Under GRANULATED HONEY we have already given some general hints; but here we wish to give some details which, while insignificant in themselves, yet, taken collectively, are sufficiently important to make all the difference between success and failure. One who can bottle honey and put it up in neat and attractive form so it will not candy at least for a year can get good prices and do a first-class business.

With one or two exceptions all extracted honey unless especially treated will granulate toward the approach of cooler weather—especially when the temperature begins to vary from 70 or 80 in the shade to near freezing or below it. As a general thing granulated honey in glass is unsalable; and in this article we shall attempt to show how to keep it liquid until it is sold.

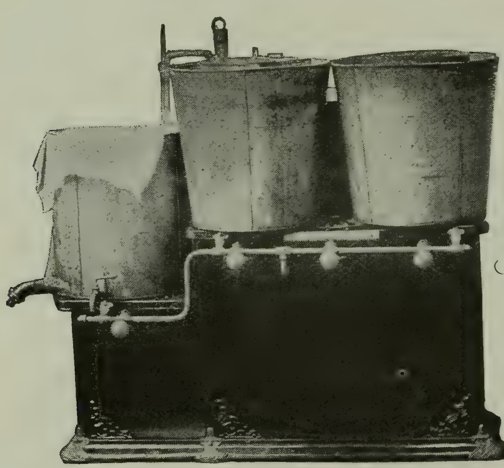
Two methods are used to accomplish this. One is to heat the honey and seal it while hot, and the other is to "sterilize" it by exposing the bottled honey to the sun's rays. We will first discuss artificial heat.

Steam from a boiler is, of course, the most convenient of any thing for heating that we can employ; but as the average reader of this book probably can not get it he must use something else. While the ordinary cooking range or cook-stove, using either coal or wood, may be used for heating honey preparatory to bottling, a gasoline-stove with three burners is far better—better because the heat *can be perfectly controlled.* A wood or coal fire is apt to burn too strongly at one time or go down at another. If the honey be overheated it will ruin it—that is, it will have been scorched or the flavor is so impaired that it will sell at a moderate price; in fact, it will be absolutely unfit for bottling, and would, therefore, have to be barreled up and sold at a low price to the large baking concerns which can use an inferior or off grade of honey. On account of the danger from over-heating from a coal or wood stove, *gasoline, gas or kerosene* should be used.

There are two methods in vogue for heating honey to be put in glass. One is, to draw it off from a large can, while cold, into cans or tumblers, and heat while in the bottles. The other is, to heat the honey in bulk, all at once, in the filling tank. Draw if off into the bottles while hot, and seal. Where one does or is expecting to do a good business in bottling, this is the method to follow; yet, on the other hand, if he has only a small trade, the other plan of heating the honey in bottles, the bottles standing up to their necks in hot water, is the one to follow, and cheaper in the first cost, for the entire outfit need not consist of more than a large shallow pan to be set on top of the cook-stove, and to hold the bottles while heating. But if one desires to keep the honey liquid in the hands of the retailer for a considerable length of time, the heating-in-bulk method is the better way. A large quantity of honey in a tank can be kept hot for five or six hours, at a temperature of 120 to 130 degrees. This low temperature long continued will keep honey in a liquid condition longer than a higher temperature for a shorter period. But, on the other hand, it may be said that a long-hot honey will not have quite as fine a flavor as the quick-heated article; but this

difference will be noted, not by the ordinary consumer, but by the bottler or honey connoisseur. As the consuming trade is one to which he is catering, the long-hot plan will, perhaps, be preferable, because it is better to sacrifice slightly on the flavor in order to secure a better appearance; that is, to keep the honey liquid until sold and consumed. Honey that candies quickly or clouds in the bottles on the grocer's shelves is likely to have a slow sale, and to kill the sale of other honey. The public is suspicious of honey that begins to show granulation, classing it as "sugared" or adulterated.

There are two methods of heating the honey in bulk that we will here describe, either one of which has its special advantage; and the reader, after going over them can determine which is the better one for him to adopt. The question of first cost of the apparatus will have some bearing on the proposition. The one used by Mr. Fowls is cheaper but not quite so efficient as that of Mr. W. S. Pouder.



Mr. Fowls' melting-tanks, siphon, and gasoline-stove.

In the accompanying cut Mr. Chalon Fowls makes use of a gasoline-stove already referred to, and puts a couple of large cans on each of the top burners. These are partially filled with water, then a square can of honey is let down in each until it is completely submerged. After the honey is all melted, a thermometer is let down as will be seen; and when the mercury rises to about 150 (not higher than 160), the honey is drawn off by means of a siphon into a filling-tank that stands on a lower step of the stove. This siphon may be of glass, as shown in the illustration, or it may be of common rubber tubing, such as can be obtained at the drug-store. The latter is to be preferred because it is more convenient to handle. While the honey is hot the tubing should be let down entirely into the honey until it is filled. To do this, attach a string at both ends and submerge it in the honey. Draw out one end and run it over into the filling-tank, which is lower down. The hot honey will now immediately run out; and as the can is emptied the water surrounding the can should be drawn off or else the can will float and tip over. From the filling-tank the honey is drawn off while hot, or about as near 100 as possible, into honey-tumblers, Mason jars, Muth jars or any of the packages already described. As soon as filled they should be sealed while hot; after which, as soon as they are sponged off in warm water, they may be labeled, when they are ready for market.

The apparatus shown in the next two illustrations can be made at any first-class tin-shop, provided a quantity of half-inch copper or block tin pipe can be secured. If this is not obtainable locally, the tinsmith can send away and get it.

The pen-drawing next page represents first a small tin boiler standing on a gas or gasoline stove; and, second, a melting-tank in which the honey is heated and drawn off into the retail packages. Boiler E can be made from any two or three gallon syrup-can with a screw top. The water-gauge on the side to indicate the level of the water is not absolutely essential, and may be omitted. If gas is not obtainable it is better to get a gasoline-burner of large dimensions, for the ordinary single burner would hardly generate steam fast enough for the purpose. If the tinsmith can not get an oven gasoline burner, he can put two common gasoline burners close together. The boiler will then have to be constructed with a larger bottom, but shallow in depth; for too large a quantity of water should not be used at a time. The heating-tank should be mounted on a level, above the boiler, and a connection made with a common hose as at G.

The tank used by Mr. Pouder is 30 inches deep, 12 inches in diameter, holding 12 gallons. While his is made of copper, and is

nickel-plated, yet one made of tin would be just as good if kept clean, and cost a good deal less.

Five or six feet of half-inch copper pipe tinned on the outside is coiled and inserted inside of the heating-tank, as shown; but instead of a portion of it lying in a flat coil at the bottom, the spirals of the pipe should rise one above the other like a bed-spring, gradually spreading further apart near the top. One end should have an opening at C and the other at G. Steam is generated in the boiler E, and finds exit at the tube C. But when the honey is first poured into the tank to be heated, all the steam will be condensed and run back into the boiler E. After the honey is hot the steam will come out at the tube C.

Contrary to what might be expected, Mr. Pouder does not find that hot steam does any damage to the flavor of his honey. The apparatus is really very simple, and occupies a small amount of room. He keeps his outfit right in his retail store on the counter where his customers can see it and its method of working, and this helps to advertise his goods.

After the honey has been run out, the heating tank should be left just as it is, without washing out unless the outfit is to stand for some months before being used again, for the honey will prevent the rusting of the tin. During this time it should be covered, of course, to keep out the dust.

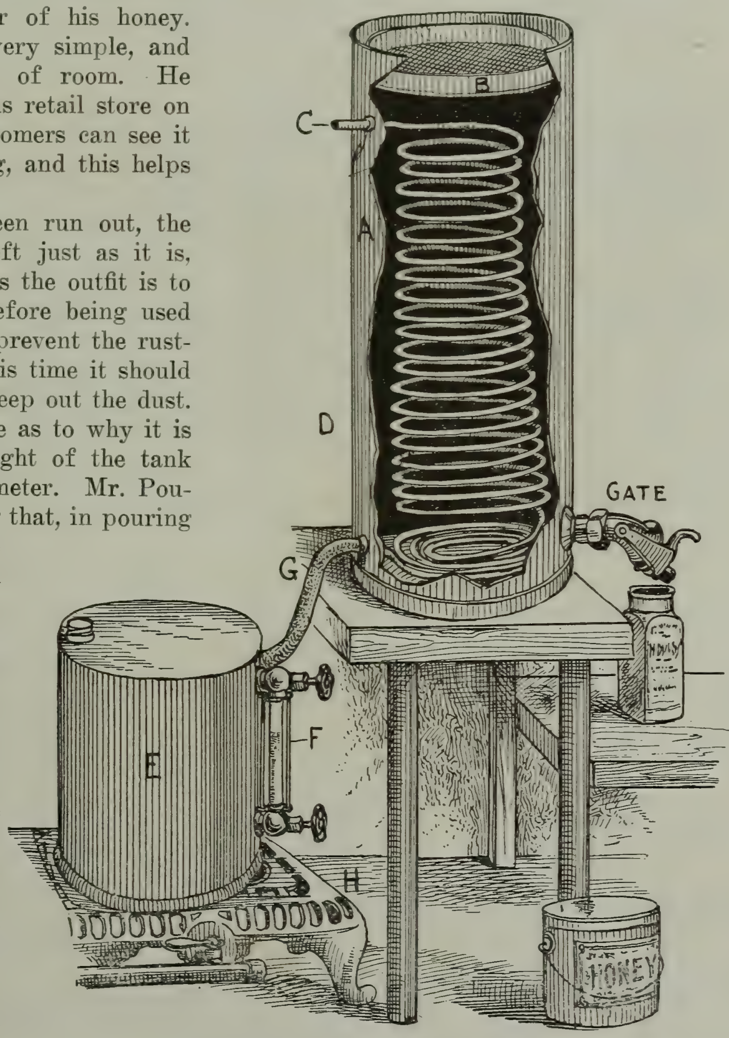
The question might arise as to why it is necessary to have the height of the tank nearly three times its diameter. Mr. Pouder explains this by saying that, in pouring honey from one receptacle to another, air-bubbles will accumulate. The deeper a tank the greater the pressure on the honey at the drawing-off point. This pressure will force the bubbles to the top. It is very important, in bottling honey, that the air-bubbles be all expelled, as they have a tendency to cause granulation.

The two outfits already shown for heating honey in bulk illustrate principles that may be applied to various kinds of tanks.

HEATING HONEY IN BOTTLES, OR BOTTLING FOR A SMALL TRADE.

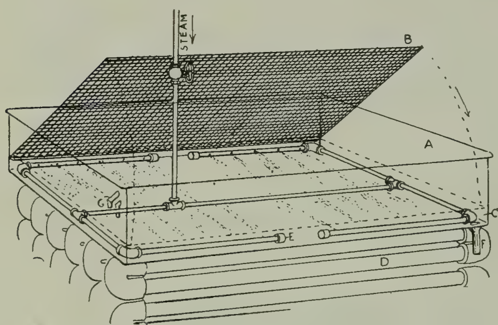
There is a class, as already intimated, who do not care to go to any great expense in a bottling-apparatus, since they have in view only a small trade. In brief, all that is needed is a shallow pan just deep enough so that the deepest bottles can be submerged in hot water up to their necks and no further.

We now need a square or oblong galvanized-iron pan as large as the top of the stove, with perpendicular sides, and about six or seven inches deep. If a gasoline-stove is used, the pan should be as long and as broad as the top; and if the three burners are on the same level, all the better. The pan should be just about the depth of an ordinary Mason jar; or, rather, the



Pouder's heating and filling tank.

depth of the deepest package to be used for bottling purposes. A false bottom of coarse wire cloth should be secured about half an inch above the bottom proper by means of proper stays. This is for the purpose of providing a circulation of water under the bottoms of the bottles, for otherwise they might break. Fill the pan about half full of water, and set it on the stove.



HEATING TRAY.

Instead of using a gasoline-stove to heat the water in the tray we use ⅜-inch steam-pipes connected as in the manner shown. The outside pipes are perforated with holes that blow a jet of steam transversely across the bottom of the pan. The wire cloth rests on the pipes. The coil of steam-pipes below serves no purpose but to keep the large filling-tank of honey warm.

When the water registers about 180 according to the thermometer, set into the tray, on the false bottom of wire cloth, the bottles of honey that have just been filled from the large filling-tank above referred to. When the pan is full of bottles placed close together the water should be raised to within about an inch of the top of the bottles. Let them stand in the hot water until the honey in one of the bottles registers about 160. They may now be taken out and corked or sealed. A fresh supply of filled bottles of honey should next be put back to replace the first lot, and the operation of heating and sealing can be continued indefinitely.

There are several advantages of this method, aside from the one of first cost for apparatus; viz.:

1. One can fill a small order at any time; and it is not necessary to heat a great bulk in order to put up a dozen bottles or so of honey. In heating a large quantity of honey one necessarily has to keep it hot a great length of time. The longer the honey is kept hot the greater the liability to discolor and impair its flavor.*

2. Bottles that are submerged in hot water can be easily wiped off with a cloth; and as soon as they are corked or sealed they are ready for labeling.

3. Any honey that has been poured into the vessels, either hot or cold, will have collected a large number of air-bubbles; and it is these particles of air that have a tendency to hasten granulation. When the honey is heated gradually in the bottles after filling, the process expels the air-bubbles; and by the time the honey is clear it is ready for sealing and labeling.

If any honey should candy one can unseal, and set the bottles in the tray of hot water, and reheat and seal without emptying.

USING THE SUN'S RAYS IN SOLAR WAX EXTRACTORS TO PREVENT HONEY IN BOTTLES FROM GRANULATING.

Mr. H. R. Boardman, of Collins, Ohio; E. B. Rood, of Bradentown, Florida, and some others, have been placing their bottled honey in solar wax-extractors, to "sterilize" the honey. Under some conditions the temperature would reach 150 degrees Fahrenheit. When this temperature is maintained for a good part of the day the heat alone apparently goes a good way toward preventing granulation; but apparently, at least, the actinic rays of the sun have some chemical effect, in addition to the heat. Mr. H. R. Boardman, who has been a pioneer in the art of sterilizing honey in bottles by the use of the heat and light of the sun, wrote an article for *Gleanings in Bee Culture,* Vol. XXXVII., page 769. This is what he says:

During the last ten years I have kept, perhaps, an average of one hundred colonies of bees, and have run them mostly for extracted honey. Nearly all of this I have put in glass packages, sterilized in my solar sterilizer, and furnished to the grocery trade or sold in my home market. So entirely satisfactory has this honey been found that I now have very little, if any, other. I am seriously contemplating cutting out comb-honey production entirely in the near future.

I started my experiments with the rays of the sun by placing granulated honey in a solar-extractor to restore it to the liquid state. So well pleased was I with the results that I continued the experiments further. In the mean time I discovered that there were some properties besides heat in the sun's rays which were being imparted to my honey that

* The longer it is kept hot, the longer it will be before it candies again. We advise erring on the side of good flavor, even if it does candy more quickly. The same honey can be remelted in precisely the same way.

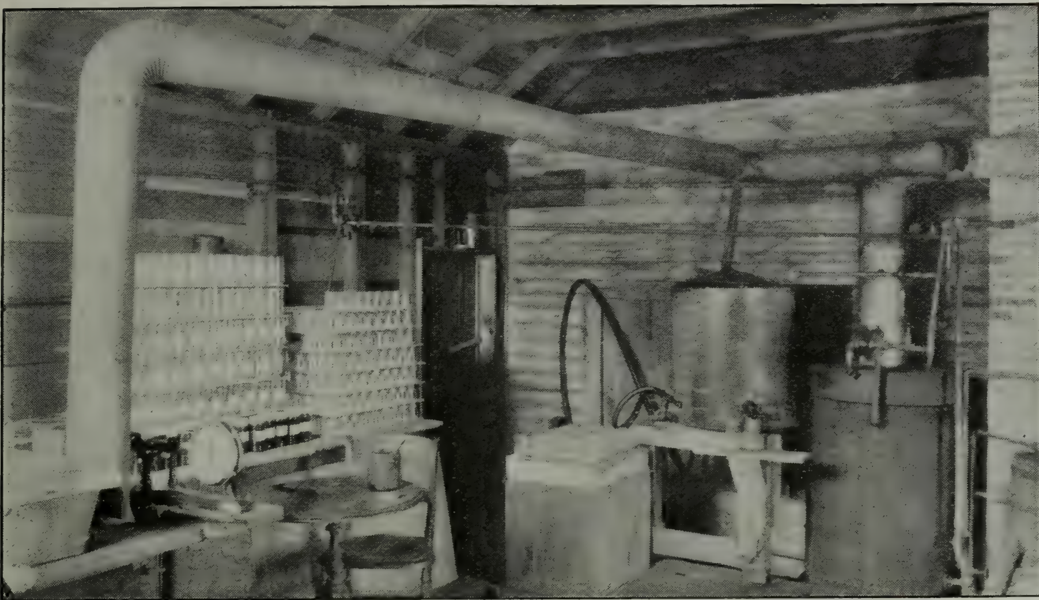


Fig. 1.—E. E. Coveyou's honey-bottling room. The bottles are filled by means of a short piece of hose connected to the honey-tank. A quick-working stop at the end controls the flow of honey into the bottles.

made it act differently from any honey that I had warmed artificially. These results led me to treat liquid honey, as soon as I extracted it, in the same way, and I found that it came out bright and sparkling, with the delicate original flavor unimpaired.

LAST YEAR'S CROP.

Some of my honey from last year I carried over. It was in two-quart jars, and all that was thoroughly treated to the sun I found remained bright and sparkling, and in perfect condition in every way. Some that had been treated hurriedly, on account of a lack of capacity of my sterilizer, crystallized more or less, but I was not disappointed in this. Honey that is often disturbed will soon show a tendency to granulate. Moisture will cause honey to granulate. Some of the jars showed some granulation. A little water got into these jars after the honey was sterilized last year. This honey grained and settled down into the clear liquid, and remained suspended in fantastic shapes.

In 1902 I sent the editor some samples of honey put up in jelly glasses, and taken from a lot prepared for market the year previous. At that time, as it showed no signs of granulating, I supposed it would remain liquid indefinitely. This was put to a strenuous test during the winter, and it granulated as reported at the time. I am entirely satisfied, however, from further experiments, that this granulating was caused by frequent handling and disturbing. I have some of this same lot of samples yet that have remained undisturbed, and there is no granulation even though seven years have elapsed.

In the light of these experiments I think it is conservative to say that honey thoroughly and properly sterilized will remain from year to year unchanged, and, under favorable conditions, will remain indefinitely without granulating. If, for any reason, the honey is not thoroughly treated, it may sooner or later show a tendency to crystallize.

In this connection I would say that I have found full sunshine absolutely essential to perfect sterilization. Unfortunately, this is a feature which we can not control. In the sunny South I know of no reason why a solar sterilizer of honey should not be eminently successful, and, to some extent, be utilized in putting up bulk comb honey.

The honey to which Mr. Boardman refers, and which he desired us to test, was placed on the window-sill just outside of the office. This honey stood outdoors during the following winter, subject to extremes of temperature; and if there is any thing that will make honey granulate, it is alternate warming and cooling. The temperature during the summer would probably go up to 90 in the shade, and in winter anywhere from 50 degrees above to 10 below zero. Certainly the conditions were favorable for making this honey granulate; but it remained liquid throughout the winter and all the following summer; but by the middle of the following winter it began to show slight traces of granulation. We do not know of any honey that has been subjected to heat alone that has stood this extreme difference of temperature for so long a period, and therefore we conclude that there must be something in the chemical effect of the sunlight itself.

The question naturally arises why large bottlers of honey do not use the sun's rays rather than artificial heat alone. Principally, we suspect, because the solar wax-extractor, for commercial purposes, is too slow; and because, further, in the northern States there are too many days without direct sunlight, especially at that time of the year when the bottling trade should be at its height. But for a *local* demand, the solar wax-extractor in the mattter of convenicure and effectiveness is probably much ahead of artificial heat alone.

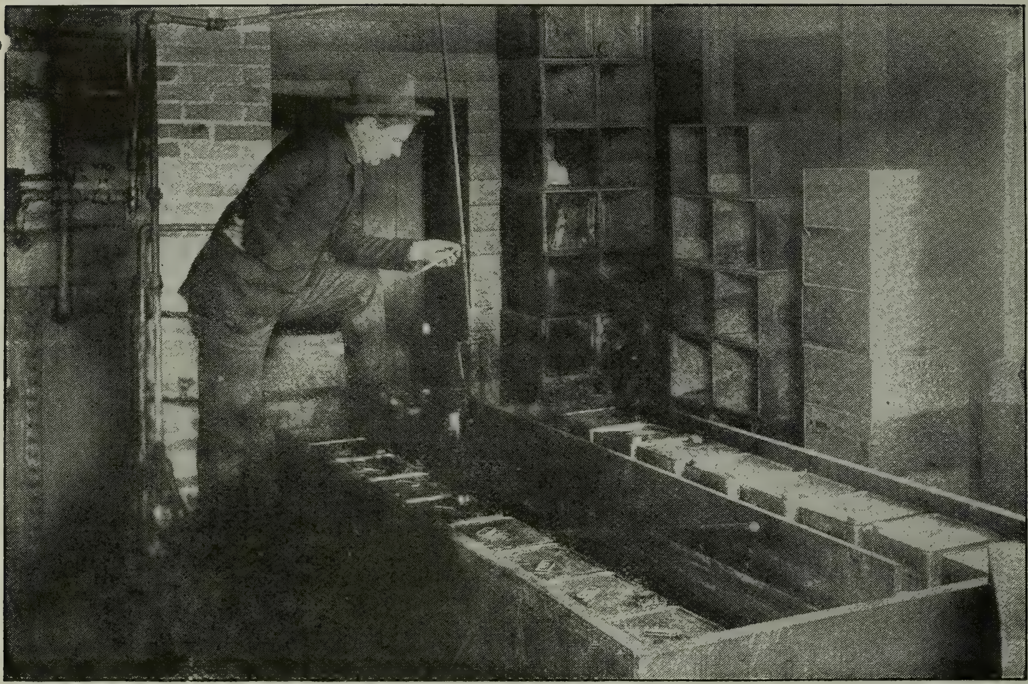


FIG. 2.—Coveyou's liquefying-tank. This is divided into two parts, each of which will hold a thousand pounds of honey. The temperature of the water in each part is controlled by a separate steam-pipe.

COVEYOU'S METHOD OF HEATING AND BOTTLING.

Mr. E. E. Coveyou, of Petosky, Mich., one of the most extensive bottlers of honey in the United States, has a very fully equipped plant. The accompanying description, together with half tones, will give a very fair idea of how he operates.

Fig. 1 shows at the right a small steam-boiler and steam-pipe leading to the different tanks. Next is the filling-tank in front of which are the glasses ready to be filled with the hose hanging at the bottom of the tank. At the left the glasses are piled up with galvanized wire screen between each tier. This makes a very good way to dry.

Fig. 2 shows our liquefying-tank partly filled with 60-lb. cans of honey. There is a partition through the center, so that 1000 lbs. of honey can be heated in each side. A lower temperature can be maintained in one side than the other, should it be thought advantageous to heat the honey slowly for the first twelve hours.

The steam-pipe in the middle is divided with valves close to the partition, so that the steam can be turned on or off to keep the temperature uniform. I am standing with a thermometer in my hand, noting the temperature. This should be done quite frequently until the right degree of heat is reached, when the valve practically does the work.

In Fig. 3 the lady at the right is my sister, Mary Coveyou, filling glasses with what Mr. Townsend has named our "wild goose bill." This is attached to a hose, and fills the glasses right in the cases, which saves handling. We find this is one of the very best methods we have ever tried. One person can fill 4000 half-pound glasses with honey in less than a day's time, in this way.

The lady in the center is my wife, showing our new way of labeling glasses. In the first place the labels are not gummed. We take one end of the package of labels and paste it, which keeps the pile together. Then the bunch of labels is also pasted upon the table, face down, which holds them securely in place. The young lady at the left does the pasting. As soon as the top label is pasted, the glass is simply rolled over it, which picks it up and at the same time presses it firmly in place. Thus the work is done without any handling of sticky labels. By this method we can label with the ungummed papers just as fast as we could with the gummed.

Mr. Coveyou's scheme for filling his honey-bottles is very unique. It is, in fact, the same general scheme that is used by bottlers of pickles and other canned goods in large canning-factories. A rubber hose is attached to the filling-tank, and on the other end is an arrangement something similar to the cover on a syrup-pitcher to shut off the syrup without drip; indeed, it opens and closes much like a goose-bill. A pressure of a little hand-lever opens the beak of the bill, as it were, and allows the honey to run into a bottle. Just the moment the honey reaches the desired level, the beak or goose-bill is closed, chopping off the honey without a particle of drip.

A quantity of the empty bottles is now placed upon a table or tray within reach of the hose. The operator grasps it, holds the beak over one of the bottles, opens it and then closes it just at the exact moment

FIG. 3.—Filling and labeling bottles. The method of filling the bottles is here shown. The top label in the bunch is pasted, and the bottle rolled over it. Thus the labels are put on without being handled at all.

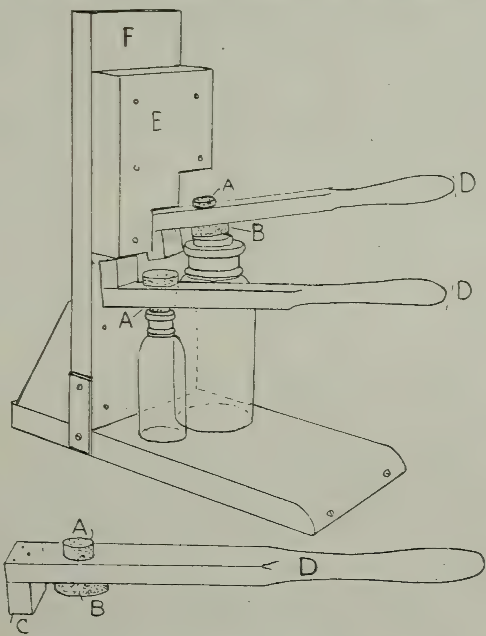
when the bottle is filled. In like manner all the others are filled without touching a single bottle until all in that lot are full. The whole tray of them is removed, when another lot is put in place.

There can be no doubt that this method of filling bottles is much more rapid than the old way of placing the bottles one at a time under a honey-gate, filling it, removing it, and filling another. It can readily be seen that the handling of the bottles necessarily consumes a large amount of time, whereas the rubber hose, with its goose-bill or beak can be moved to any one of the bottles where they stand, and fill them one by one in the shortest space of time.

WASHING AND CLEANING BOTTLES.

Prepare several tubs of water—one of them with strong suds—and then have on hand a few ounces of shot—No. 6 is about right. If particles of glass or dirt cling to the inside of the bottles, pour in four or five ounces of shot and give the bottle a shaking. This will dislodge all particles, when the shot may be poured into another bottle, to be similarly treated. In rinsing, use clear soft water. Hard water is liable to leave traces of sediment. Any glass package used for honey designed for table purposes should be spotlessly attired.

HOW TO INSERT CORKS IN BOTTLES.



Two or three methods are employed. One is, to use a rubber mallet, which can be purchased at any of the rubber-stores. The ends of the mallet being soft, a cork that

is barely entered can be driven into the bottle with a blow.

Another plan is to use a lever, as shown at D, in cut. This lever should have a projection on the under side so the cork can be forced down into the bottle about a sixteenth of an inch. It is important, after corking, to pour a layer of paraffine or wax over the top of the cork. Some go so far as to dip the corks into hot paraffine, then pour a hot layer on top after they are inserted in the bottles. Nay, some go even farther. After the corks have been paraffined they put on a neat tinfoil top. If the honey has been heated above 160, and sealed while hot, and the cork is made impervious, it will remain liquid for months; as we have seen samples of honey put up in Muth jars that have been kept in a refrigerator six months, and yet it would remain perfectly clear all the time. But do not advise your grocer customers to put honey in a cold place. The bottles should not be handled more than is necessary, but be kept in a warm place at as uniform a temperature as possible.

Assuming that no directions are necessary for sealing packages using rubber rings, we would say this: That you must be sure you make the sealing as tight as possible. In the case of Mason jars, screw the tops down with a wrench, and *screw them down tight.*

In sealing jelly-tumblers, cut squares of paper (preferably paraffined paper) about the size of the top of the tumbler. When the jar is filled, put the paper on top of the jar, and squeeze the top down with the palm of the hand, putting a large part of the weight of the body on it. If the top goes down too easily, use thicker paper or two thicknesses.

A BLEND OF SEVERAL KINDS OF HONEY FOR BOTTLING PURPOSES.

The seasons for honey production are so uncertain at times that one finds himself unable to supply his trade with the honey he produces from his own yard. If, for example, his honey is almost exclusively from clover, with little or no basswood or fall flow, the trade will become educated to like that particular flavor, and will reject all other honeys of other flavors on the ground that they are impure. To provide against a contingency of this kind it is advisable to use from the start for bottling purposes a honey that can always be furnished year after year. We make a blend of white clover, basswood, alfalfa, and mountain sage. These are fine table honeys; and if the trade is supplied with this blend from the very start it will become accustomed to it. Such a blend can be made up of honeys that one can purchase when local honey fails; whereas if one puts up only white clover at the beginning, he will find it difficult to purchase a strictly pure clover except at highest prices. Where one lives in a clover locality he will do well to make up a blend of 50 per cent of clover, 25 per cent of sage, and 25 per cent of alfalfa. We will assume, for example, that he has a season of failure, and yet the bottling trade keeps up just the same. He usually buys a mixture of clover and basswood. His taste will become educated so he can determine the percentage of the one to the other. Then by putting in a small amount of alfalfa, which he can always procure, he will be able to supply his trade with the proper blend.

If one lives in a locality where alfalfa is produced extensively, there will be no need of having a special blend, because the pure alfalfa can usually be obtained in most of the irrigated regions.

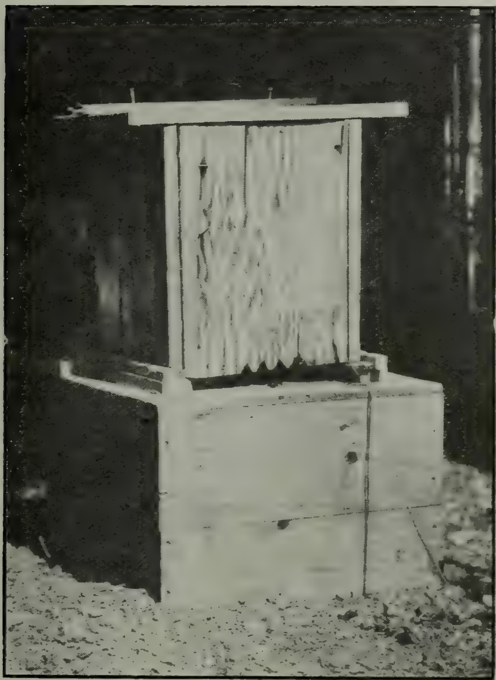
REQUIREMENTS OF THE LAW AS TO LABELS.

It will be well to state that the national pure-food law, and in some cases State laws, requires that the label shall indicate the exact contents of a package; and therefore it would not be advisable to call a blend, such as we have described, a *pure* clover. It will be perfectly proper to say "pure extracted honey bottled by John Jones;" but John Jones must not say "pure extracted honey from the apiary of John Jones" unless such honey did actually come from his apiary.

LABELING BOTTLED HONEY.

As a general rule, use small circular labels. The big ones that cover up the whole jar do not usually afford as pretty an effect as the small neat tasty labels that give the customer a good chance to see the honey. It is the honey that sells; and if it is a fine quality, get the grocer to display it in such a way in his window that the light will sparkle through it, and we will guarantee it will sell.

BOX HIVES.—It seems as if any description of box hives in a work to teach modern apiculture would be out of place; but since many have never seen any thing but a movable-frame hive, and the



A type of box hive largely used 50 years ago, and still found in old-fashioned apiaries.

old box hive is occasionally referred to in various portions of this work, perhaps a brief description should be given.

These hives, as the name indicates, are merely boxes containing neither brood-frames nor movable fixtures. They usually consist of a rude rough box about a foot square, and from 18 to 24 inches high. Through the center there would be two cross-sticks, the purpose of which was to help sustain the weight of the combs built in irregular sheets within the hive.

At the close of the season it was the custom for the apiarist to go around and "heft" his hives. Those that were heavy were marked to be brimstoned; and those that were light were left to winter over for next season if they could. The bees of the first named were destroyed with sulphur fumes, and then the bee-bread, honey, and every thing were cut out.

In the more modern box hives there were boxes with glass ends that could be drawn out from an upper part, leaving the lower intact. In this case the bees were not destroyed. In any case there was no opportunity to inspect combs, hunt queens, divide, nor perform any of the hundred and one operations of modern apiculture.

When one compares the crudity of these methods with those that are described in this book, he sees what wonderful progress has been made in apiculture.

BROOD.—See Bees; also Diseases of Bees.

BROOD, SPREADING.—See Spreading Brood.

BUCKWHEAT.—(*Polygonum.*) This, in certain sections, is one of the most important honey-plants. It is grown principally on the hillsides of Eastern New York, Pennsylvania, and to some extent in Michigan and Ontario, Canada, and in these localities where there are thousands of acres within a radius of a few miles, immense quantities of buckwheat honey are annually produced. On one hilltop in Schoharie Co., N. Y., near Gallupville, where we stood, we were told that within a radius of three miles the bees had access to 5000 acres of buckwheat, all of which was within the range of the eye. So great is the acreage of it in New York that anywhere from 2000 to 3000 colonies can be kept in some counties; and this means hundreds of beekeepers who are specialist honey-growers and farmers, almost all of whom keep at least a few colonies. The latter class reason this way: That the growing of the buckwheat as a grain is one of the most profitable branches of farming; that the nectar in the blossoms properly belongs to them, and if they keep a few colonies they will virtually get two crops from one field—honey and buckwheat grain.

We have ridden a bicycle through the buckwheat region of New York, traveling all day, without losing sight of buckwheat fields that seemed to cover every available piece of ground on both sides of the road. So immense are the fields that the atmosphere seems to be heavily charged with the aroma of the bloom, and if one is not a lover of buckwheat honey the odor is somewhat sickening.

One beekeeper in the heart of the buckwheat country (W. L. Coggshall, of Groton), who lives near Cayuga Lake, har-

vested one year with his 1000 colonies 78,000 lbs. of honey; another year 50,000 lbs.; and for a good many years his crops have ranged along into the carloads. The late E. W. Alexander, of Delanson, N. Y., also produced immense quantities of this honey. So much buckwheat grew around that he maintained 700 colonies in one yard for years. While the honey produced by these men was not all buckwheat honey by considerable, yet a good big portion of it was.

But the growing of buckwheat is by no means confined to the East. It is grown in small acreages of, say, one to five acres, in most of the North Central States. It also is a paying crop for seed and honey in the South, being grown largely in South Carolina and Texas. But it is in Eastern New York, on the hillsides, that it seems to thrive best. Stalks of the celebrated Japanese variety that would measure two feet high in Ohio will reach five or six feet in length in the more favored locations in New York. There is something in the climate and soil of those hills that makes the growing of this plant much more profitable in the East than in the West, although it is always a paying crop for the grain in nearly every locality where ordinary grain crops can be grown.

Japanese Buckwheat.

THE QUALITY OF BUCKWHEAT HONEY.

Buckwheat honey itself is of a deep dark purplish tint, and looks much like the old New Orleans or sorghum molasses. It is usually of heavy body; and the flavor, to one who is a lover of clover and basswood, and who has never been accustomed to

Japanese buckwheat thirty-four inches high in a little over three weeks from the time the seed was planted.

buckwheat honey, is more or less sickish; and yet those who have always been used to buckwheat honey, or at least a good many of them, prefer it even to clover or basswood.

A lady from the East once called at our store and looked over our honey. We showed her several samples of choice clover and basswood comb honey.

"I do not like this," she said. "It looks like manufactured sugar honey. Haven't you any buckwheat honey?"

"Yes, but we did not suppose you would like that, because such honey rarely sells in our locality."

We then placed before her some sections of buckwheat honey, and these suited her exactly.

"*That* is real bee honey," said she, with a look of satisfaction, and she carried home several sections.

It seems that her father had been a beekeeper, and about all the honey she ever saw was buckwheat; and unless it had the strong flavor and dark color of the honey she was familiar with in her childhood days it was not honey to her, and there are thousands like her in the East.

Yes, there is a fancy trade that prefers buckwheat; and this trade is so large that buckwheat honey in New York and Albany brings almost as high a price as the fancy grades of white; but in the Western markets, principally in Chicago, "the stuff" goes begging a purchaser, and sells as an off grade of poor honey.

Notwithstanding the color of buckwheat honey itself is purplish, the cappings of the combs, especially if made by black bees, are almost pearly white. Some of it at least is very pretty, and especially when it is put up by practical beekeepers who know how to produce a first-class grade of any honey.

IS BUCKWHEAT A RELIABLE SOURCE FOR HONEY, AND WHEN?

In York State, buckwheat can be depended upon almost every year for a crop of honey, but in the West it is rather uncertain, some years yielding no honey, and others doing fairly well. But when it does yield, the bees work on it almost entirely in the morning, the nectar supply lasting until about ten or eleven o'clock. There are, however, exceptions.

In the East, if we are not mistaken, on account of the immense acreage, the bees are kept busy gathering honey from morning till night; and owing to the fact that it can be depended on almost absolutely for a yield of honey—when even basswood or clover fails, as it does sometimes in any locality—the beekeeper is able to make at least expenses and something besides. Indeed, some years when there is almost a total failure of white honey, the York State honey-producers are enabled to make a fair living from buckwheat alone.

DIFFERENT VARIETIES OF BUCKWHEAT.

The first buckwheat of which very much became known was designated as the black and the gray. Later on, the silverhull came into prominence, and still later the Japanese. As this latter had a larger stalk and a larger grain or berry, it was supposed

that it was much superior to any other variety. For a number of years it was grown very extensively. While it might grow more bushels of grain to the acre, it didn't necessarily follow that it would grow more flour to the acre. It was also discovered that it did not yield honey quite so well as the old-fashioned varieties; namely, the black, gray, and the silverhull. In New York, where buckwheat is grown so very largely, the Japanese has been dropped almost altogether, and the gray and the silverhull are now being used as it was formerly.

BUCKWHEAT A PAYING FARM CROP.

We have set it down as a rule in this work that it is not profitable to grow any honey-plant unless the seed will pay the expense of the crop. In this case buckwheat, as we have shown, is one of the most profitable grains that can be grown; and outside of any honey it may yield, there is "good money in it." In our own locality the yield of nectar from buckwheat is so irregular and so scant from season to season that we do not get very much honey; and yet when it does yield it affords an excellent diversion for the bees, keeping them out of mischief when there would be an absolute dearth of honey from every other source; hence even in Ohio it pays to grow it.

CONDITIONS UNDER WHICH BUCKWHEAT YIELDS NECTAR.

Probably no beekeeper has ever had a more extended experience with buckwheat as a honey-plant than the late E. W. Alexander. He observed that the secretion of nectar varied greatly with the temperature and with clear or cloudy weather. He said: "Several years ago I kept nearly 200 colonies in a location where there was barely 100 acres of buckwheat within reach of my bees—that is, within four miles, or in a circle eight miles in diameter. Still, with this small acreage per colony it was no uncommon thing to harvest a surplus of 15 to 20 lbs. of nice buckwheat section honey per colony. This caused me to feel very anxious to keep bees in a buckwheat location where thousands of acres were raised annually; so I moved to this place (Delanson, N. Y.). But I soon found out, to my sorrow, that the amount of bloom had but little bearing on the amount of surplus I obtained; and in this respect buckwheat is no exception to other flowers, aside from the fact that it does its best when we have quite cool nights followed by a clear sky and a bright hot sun with little or no wind; then from about 9 o'clock in the morning until 2 in the afternoon it secretes nectar very fast. We seldom find a bee at work on it much earlier or later in the day. Buckwheat does not amount to much in cloudy weather, even if the day is warm. With a temperature below 70 degrees on a cloudy day, bees will waste away fast on either goldenrod or buckwheat. They simply crawl around, unable to fly; and unless they get a bright sun the next day they soon die. A few years ago, at the beginning of our August harvest, when there were at least 1500 acres of buckwheat in bloom, and the bees were bringing in nectar very fast, a heavy thunder-shower came down from the north about 2 P. M., which caused the mercury to drop 21 degrees in less than half an hour. A low temperature of about 65 degrees, with windy cloudy weather, lasted some 11 days, during which the flowers ceased entirely to secrete nectar, and the bees were compelled to destroy large quantities of their brood.

HOW TO PREPARE THE SOIL FOR GROWING BUCKWHEAT, AND WHEN TO SOW.

Two crops of buckwheat *can* be grown in a season, but usually they do not pay. In such case the first must be sown very early—so early that it is liable to be killed by frosts after it comes up. Very hot weather coming on while it is in bloom proves unfavorable to the maturing of the seed. Buckwheat ordinarily should be sown after some other crop, anywhere from July 1 to the middle of August, depending on the locality. Almost any soil can be used for growing it; but the better the soil, the larger the crop, of course. Some recommend loose mellow ground, or clover sod turned under. Others say plow immediately after sowing oats or planting corn, as by thus working the soil *early* it becomes settled and holds the moisture which buckwheat demands; and the result is, the seed fills better. After plowing, the ground should be thoroughly harrowed, and then the seed sown with a drill. If a fertilizer is used, it should be put in at the same time with the seed and run through the drill.

One experienced grower says the sowing should be done while the ground is dry and dusty, and never immediately after a rain. After sowing, the surface should be immediately rolled to compact the soil, as the grain sprouts more quickly, sometimes showing above ground in less than four days.

Mr. J. H. Kennedy, of Quenamo, Kan., tells us of a crop of 116 bushels of Japanese buckwheat that cost him next to nothing. After turning under his oat stubble in July, as it was too early to put in wheat he sowed the ground to buckwheat with a drill. This came off so soon that the ground was in almost as good condition, apparently, for sowing wheat as it was when first prepared. He then put the drill right on to the buckwheat stubble, and next season reported that the wheat sown on this stubble looked exactly as well as the rest sown on other ground. It is probable that a plant so different in its habits from wheat will take little if any of the necessary plant food for wheat from the soil; and it is a common remark that nothing fits the ground so nicely for a succeeding crop as buckwheat.

The amount of seed to the acre varies according to the locality. On good land, two pecks per acre is recommended as enough; on thin soil, three pecks. One can increase the yield on thin soils by the use of 50 lbs. of phosphate and 50 lbs. of plaster mixed and drilled in, according to W. L. Coggshall, of Groton, N. Y., to whom we have already referred. The same authority estimates that buckwheat is one of the best crops to subdue rough land, and that it always leaves the ground in good condition for potatoes and oats, and almost any crop except corn.

SOWING BUCKWHEAT IN THE SPRING.

Buckwheat can sometimes be grown in the spring, providing one is lucky enough to get it out just after the last frost. Buckwheat likes warm or hot weather; and if the spring is favorable a spring crop can sometimes be grown. But, as a general rule, it is much more profitable to grow it after some other crop, as already recommended.

Buckwheat as a fertilizer of soil is one of the best. Sometimes after late sowing, early frosts nip the stalks. In such cases we would always recommend plowing it under before the plants wilt. It will more than pay for its cost as a fertilizer, and some buckwheat-growers, we understand, enrich their soil every so often in this way; even when the frost does not come in to spoil the crop. In this case they wait till after the blooming to get the honey and then plow under. Indeed, several prominent men recommend plowing in two or even three crops of buckwheat, one after another, if short of manure, when it is desired to get the ground into a high state of cultivation.

The best crop of buckwheat we ever had was after plowing under a crop of red clover. The influence of clover and abundant rains matured the grain in just 65 days after the sowing; and as the seed was not sown in the first place till after the 15th of August, our experiments showed that, under favorable circumstances, buckwheat is a very speedy crop. There was no killing frost that season until the last of October, but this, of course, is unusual.

SOWING BUCKWHEAT AND CRIMSON CLOVER AT THE SAME TIME.

During the last two or three years we have had excellent success in sowing crimson clover with buckwheat, especially where both were put in along the last of July or first of August. They come up together; but the buckwheat, being stronger, takes the ground, and the crimson clover makes but little showing until after the buckwheat is harvested. Then the crimson clover, during cool moist fall weather, rapidly covers the ground. If frost should kill the buckwheat, the crimson clover will rise up above it and hide its black unsightliness in a very brief period; and the dead buckwheat seems to be just the sort of mulching that the clover needs. The finest crop of crimson clover we ever grew or saw was sown in this way, and turned under the following June, for planting potatoes.

HOW TO MAKE BUCKWHEAT A PAYING CROP.

Our neighbor, H. B. Harrington, has grown buckwheat for years. He writes:

> Buckwheat is the best, and, in fact, the only artificial honey-pasture that a beekeeper can supply himself with at a profit, from the middle of July, when basswood and clover are past, up to the middle of September, when the fall bloom of wild flowers commences. There are no arbitary rules that can be laid down as to its culture, because buckwheat, probably more than any other grain, will adapt itself to seasons and conditions. Very hot weather will sometimes blight it if you sow too early, and early

McGowan's buckwheat in full bloom in Butler County, Pa. Mr. McGowan, by a close study of the details, prevents failures and makes the crop a very reliable one.

frosts destroy if you sow too late in the season; so you see you have a seed time from the 20th of June to August 1; and we once harvested over 40 bushels of very fine buckwheat per acre from a crop drilled on the 4th of August; but we used over 300 pounds of first-class blood-and-bone phosphate per acre.

It is a strong point in favor of buckwheat that it is a quick grower, and can succeed another crop. That crop was on the ground only 51 days from the time it was sown until the day it was thrashed; and the next day we drilled the same field to wheat without even the use of a dray and but very little extra fertilizer. The buckwheat left the land so mellow that it was the finest kind of summer fallow. We always raise our largest crops of wheat when we sow after buckwheat.

It is easy to see where the profit comes in from two crops where you have only to plow and fit the land once. If the buckwheat comes off too late for wheat, sow the field to rye.

In this section rye is the surest crop that can be raised. Never sow rye before the middle of October; and if you get the crop in by the first or even the 10th of November you run no great risk. Rye ground fine is the cheapest feed that we ever fatted hogs with. Small potatoes cooked and mixed in were used. It is still better to let the rye meal soak in water at least two days before feeding.

Now to beekeepers who want the crop for honey. Plant the crop at three different times to prolong the honey-flow, and you will be sure to hit the lucky time for a good field of grain. Buckwheat, on an average, will occupy the land about sixty days. It will commence to yield honey in fifteen or twenty days from the time it is planted, and take about ten days to mature after the honey-flow ceases.

Sow the first crop on the 20th of June; the second crop on the 4th of July, and the third on the 18th of July. We pick the 18th because the best crop we ever raised was sown on that day.

Now, what is the grain worth? The best home-grown feed for dairy cows that we ever tried, and we have fed lots of this, is one-third buckwheat, one-third corn, and one-third oats. Rye is a good substitute for the corn in this mixture. Thirty-two bushels of buckwheat is equal in value to fifty bushels of oats, and it is just as good feed for a horse as it is for a cow.

Buckwheat is the greatest weed exterminator that a farmer can use. Plow in June and till well, and two crops will exterminate and clear any field of Canada thistles.

Now one word to potato-raisers. Plow under your best crop of clover about the first of July. Sow the land to buckwheat and to rye in the fall. The following June turn the rye under and you have the best conditions for potatoes that we ever tried.

Buckwheat will thrive on any kind of land, and pays well for the good phosphate that may be used. Don't be afraid to use a roller on the newly plowed land. Make a fine seed-bed. On heavy clay soil sow three or four days before a rain if you can. If a heavy rain crusts the soil before the plant comes up, it is apt to weaken it.

Again, Mr. J. H. McGowan, of Prospect, Pa., sent an article for *Gleanings in Bee Culture,* Vol. XXXVIII., page 151, that is worth giving here in full.

I send a snapshot of a buckwheat field in full bloom. The growing of this crop here is considered by some an uncertainity, while others call it a "sorry crop;" that is, they are sorry when it is good that they did not sow more, and sorry, when it is bad, they sowed so much. But in this article I will try to tell how one may be almost sure of getting plenty of bloom (what the beekeeper likes to see) and plenty of straw and grain.

KIND OF SOIL.

To grow this crop to its best, several things must be taken into consideration. First, the soil. Any kind of well-drained land will answer. Buckwheat will not grow on ground that is wet and heavy or where the water stands and gradually dries up, leaving the soil in a hard, lifeless condition. It does best where the land is naturally dry, or made so by proper draining.

PLOWING AND PREPARING THE LAND.

Here in Butler Co. we begin to plow just as soon as corn is planted—about May 25. Each day's plowing is rolled or dragged down in the evening. This is important, as one should keep in the soil all the moisture that is already there. We follow this plan until plowing is all done.

HARROWING AND SEEDING.

Now, then, the work is only partly done, as it is necessary to keep after this field with a good spring-tooth harrow or disk and roller alternately until seeding time, when the seed-bed should be perfectly clean, fine, and solid. It is now ready to drill in (never broadcast), providing the proper time is at hand. Here we drill from July 1 to 20. *Early* sowing insures a large yield of straw and bloom, while *late* sowing usually fills the best, as the sun is then not nearly so hot during the time of bloom. I have seen fields sown early turn brown in two days on account of the hot sun.

HOW MUCH SEED TO SOW PER ACRE.

One and a half bushels of Japanese, and one bushel of silverhull or little black is about right. In the Japanese variety the grain is larger and the stalk does not branch out as much as the other two varieties mentioned. This is the reason why more Japanese should be sown per acre; but if *honey* is a consideration I would advise sowing the little black or silverhull, as it blooms until cut or killed by frost.

THE USE OF FERTILIZER.

There is another important factor in the raising of this crop; and that is the use of fertilizer. We never think of growing it without using from 100 to 150 lbs. per acre of acid fertilizer, costing from $10.00 to $12.00 per ton. It just seems to make it boom—makes both grain and straw, and a much larger yield. Last year I sowed three fields to buckwheat. The first one was drilled in July 6; the straw was medium, and yielded 16 bushels per acre. The second was drilled in July 11; straw heavier than that in the first field, and yielded 22 bushels per acre. The third was drilled in July 19, straw like the first field, but yielded 25 bushels per acre. As a rule early sowing gives large straw and a poor yield in bushels, while late sowing is the opposite.

Here buckwheat is grown for the following reasons: It comes quick; is easily harvested; is a splendid bee pasture; in fact, it is all we have to depend on. The straw is valuable on the farm. The flour has a ready sale at good prices on account of its national reputation. Nothing is quite so good as buckwheat for poultry; and when ground in connection with corn and oats it makes the best kind of feed for milch cows.

I would urge every beekeeper, if at all possible, to put in at least a few acres for the bees, and to furnish some of those good warm cakes which we all like for breakfast.

Caution.—It is a fact that buckwheat honey occasionally contains 33 per cent of water, and is, therefore, too thin, according to the formula of the national pure-food law passed June 30, 1906, which limits the amount of water in honey to 25 per cent. It will be necessary, therefore, to evaporate thin honey to make it conform to the law.

This may be done by means of a honey-evaporator, or by storing it for a while in a hot dry room. Beekeepers need not hesitate to go to the extra trouble involved by the law, since the honey is really so much improved, and ought to command a higher price.

GIVING AWAY BUCKWHEAT SEED TO FARMERS.

This may sometimes be done profitably in localities where buckwheat is not grown at all. By furnishing seed to farmers for one or two years free a beekeeper may thereby be able to get the farmers to put it in as a regular crop, year in and year out. We would not advise giving away the seed free after the second year. During the third or fourth year, furnish it at half price. We never give it away nor furnish it free to any one more than a quarter of a mile from the bees.

For further particulars on the question of whether it pays to give away seed like this, see ALSIKE under head of CLOVER, and note particularly what Mr. Goodhue and Mr. William McEvoy have to say on the subject.

BULK COMB HONEY. — See COMB HONEY.

C

CAGES FOR QUEENS.—See INTRODUCING.

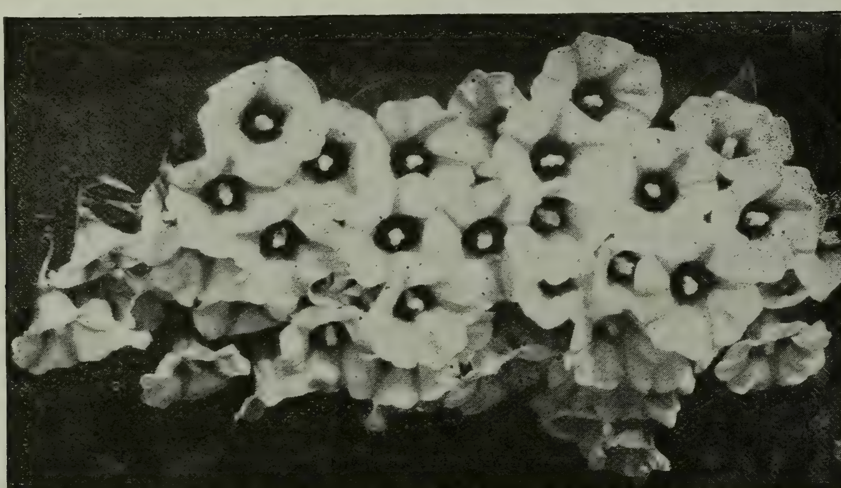
CAMPANULA.—A plant that stands first in importance to the beekeepers of Cuba is the campanula, or bellflower, a species of the morning-glory. There are several varieties, but only two of them seem to yield honey— the *campanula blanca* and the *campanula marada.*

Campanula blanca, or white bellflower, is of most importance. It is a perennial, the vines sometimes obtaining the size of from two or three inches in diameter, and is generally found growing among trees and shrubs or along fences and stone walks. The height of bloom is about Christmas, for which reason it is also called the "aguinaldo blanca de la pasque," and at this season of the year it is a common sight to see almost every tree, shrub, and fence along the road one solid mass of white aguinaldo bloom. The odd feature about this plant is its irregular blooming. It will bloom only every other day, and then, again, several days in succession. The days of blooming are always universal. One day every vine is in full bloom; the next day not a single vine is to be seen in bloom in miles of travel.

PINK BELLFLOWER.

Campanula marada, or pink bellflower, is an annual. It blooms during the months of October and November. It is found principally in western Cuba, in the region known as the "vuelta abajo," the great tobacco region; and it is the growing of tobacco that makes possible the great amount of this particular variety of the bellflower, for tobacco seed is, as a rule, always sown on virgin soil. Large tracts of land, on both mountain and coast, are cleared every year, just to grow one crop of tobacco-plants. When the plants are big enough to be transplanted they are pulled and shipped by railroad, ox-cart, or mule-train, to where the tobacco is to be grown. These tobacco-seed beds are, by the next year, and for years to come, covered by the vines of the campanula marada, which, in western Cuba, springs up wherever the land has been cultivated.

The honey from the bellflowers, in color and flavor, is equal to alfalfa or sage. The comb built during the bellflower flow is pearly white, and when melted it produces wax as white as tallow.



Campanula, or bellflower.

CAMPECHE.—See LOGWOOD.

CANADA THISTLE — (*Cirsium arvensis* L. Robs.), though condemned by agriculturists and experiment stations, and outlawed everywhere, is a very important honey-plant in some parts of Canada. While beekeepers, of course, will do nothing to spread it, and should do every thing in their power to kill it out, yet if it must exist, there is no wrong in getting a little something out of it, and that something is a great deal to the beekeeper. This thistle is much like the common thistle of the central-northern States, but a little smaller, with a bluish-purple head of flowers.

The honey is of a very fine quality, good color, and will rank with the best clover or basswood in almost any market. It is a commercial asset to the beekeeper only in those localities where it has come to be a pest among the farmers, who would exterminate it root and branch if they could. Our laws are now so rigid that the weed will probably never get very far in the States; and any farmer who has any regard for his own interest will stamp it out on sight.

CANDIED HONEY.—See Granulated Honey.

CANDY FOR BEES.—There is just one kind of candy that is used universally by beekeepers for queen-cages. While excellent for this purpose it should not be used as winter food unless in pans, where, if it becomes soft, it will not run down and kill the bees.

It is none other than what is popularly termed the "Good" candy, after I. R. Good, of Nappanee, Indiana, who introduced it into this country. It was, however, first made by a German named Scholz, many years before. See "Langstroth on the Honeybee," p. 274, 1875 edition. By Europeans it is, therefore, called the Scholz candy.

HOW TO MAKE IT.

Make a stiff dough with first quality of extracted honey and powdered cane sugar. Do not use beet sugar. These were all the directions given at first; but it would seem that, from the difference in results, more specific instructions are necessary. Mr. J. D. Fooshe (or, rather, his wife, who does it for him) has been very successful in making the candy. Their method is as follows: Take good thick honey and heat (not boil) until it becomes very thin; then stir in pulverized white sugar.* After stirring in all the honey will absorb, take out the mixture and thoroughly knead it with the hands. The kneading makes it more pliable and soft, so it will absorb, or, rather, take up more sugar. For summer use it should be worked, mixing in more sugar until the dough is too stiff to work readily, when it should be allowed to stand a day or two; if then so soft as to run, a little more sugar should be kneaded in. Much will depend upon the season of the year. More sugar is required in proportion to the honey in warm or hot weather than for cool or cold weather. It should not be too hard in winter, nor so soft in summer as to run and daub the bees. For this reason the honey, before mixing, should be heated so as to be reduced to a thin liquid. In shipping bees, the main thing to look out for is to see that the candy does not run nor yet get hard. It is one of the nice points in making this candy to have it just right. Don't delude yourself with the idea that a second quality of honey will do. Always use the nicest you have. We get the best results with first quality of clover extracted. Sage honey, for some reason or other, has the property of rendering the candy in time as hard as a brick, and, therefore, should not be used.

There is not very much trouble in mailing queens to Australia, if the candy can be made just right so as not to become too hard nor too soft on the journey. If it retains a mealy, moist condition, the bees will be pretty sure to go through all right. See Introducing.

HARD CANDY FOR WINTER AND SPRING FEEDING; HOW TO MAKE IT.

Into a dish of hot water on the stove slowly pour an equal amount of sugar, stirring constantly. Make sure that the sugar is all dissolved before boiling commences. If this precaution is not observed, some of the undissolved sugar is likely to burn, injuring the flavor of the candy and almost surely causing trouble with the bees later. If you have a candy thermometer, watch the temperature, and do not let it go above 275 to 280 degrees. Test frequently by dropping a very little of the syrup into cold

* Confectioners' sugar—a grade of pulverized sugar—will not answer as it generally contains starch. While such sugar is all right for frosting cakes it is death to bees.

water (about 50 to 55 degrees F.). When the boiling has continued long enough the drop of candy, when cooled in the water, should be hard and brittle when taken out; but when placed in the mouth it should soften slightly, so that it is tough. When this time has arrived, pour the syrup immediately on to paraffined or waxed paper on a table. Have the table perfectly level, and around the outside of the paper put wooden sticks ¼-inch high to confine the syrup and prevent it from running off. When the candy is nearly hard, crease it or cut it with a heavy knife so that it may be broken up into right-sized squares when hard.

The color of the candy when cold should be about that of light basswood honey. If it is darkened very much it is scorched and unfit for the bees. To prevent the scorching, reduce the fire toward the last so that the syrup will boil but slowly.

When the candy is first made, it is hard and glassy, and perfectly transparent; but after it stands for a little time it becomes somewhat watery and crystalline; but this is all the better so far as the bees are concerned, for they are enabled to take it more easily.

The thin cakes of candy being only ¼ inch thick may be placed over the frames and under the regular cover, and in this way a colony saved that would otherwise be lost. The feeding of syrup, especially in the spring, is apt to cause great excitement and possibly robbing, and for this reason the candy is safer as it takes it slowly.

Caution: — Whoever makes the candy should clearly understand that if the mixture is scorched, even the slightest, it will make unfit food for spring or winter feeding. When the syrup is cooked nearly enough, there is great danger of burning, and it is *then* that the greatest care should be exercised.

CANE SUGAR.—This is the common name applied to the sugar-sucrose. Sucrose is made from the sugar-cane and also from the sugar-beet. When derived from the beet it should go under the name of beet sugar. Sucrose is found in pure honey in amounts varying from nothing up to 8 per cent. Only in a very few cases has pure honey been found which showed the higher figures. The standards for pure honey allow 8 per cent to be present. New honey generally contains more sucrose than old honey. There are present in honey before heating some enzymes (unorganized ferments) which have the power to invert the sucrose. Hence on ageing, if heat has not been applied to kill this action the per cent of sucrose decreases. Sucrose on hydrolysis or inversion forms equal parts of dextrose and levulose, these latter being the predominant sugars of honey. See Sugar.

CANS FOR HONEY.—See Extracted Honey.

CARNIOLANS.—See Bees.

CARPET GRASS.—*(Lippia nodiflora* L., Michx.*)*. Another vernacular name is fog-fruit. *Lippia repens* Hort. introduced into California less than ten years ago has extended over thousands of acres, and is constantly visited by bees. The carpet grasses belong chiefly to the Southern States, California, Mexico, Central America, and the warmer regions of the Old and New World. In Central America it produces abundantly, and has been reported in the Bermudas, where it is the leading honey-plant, and also in the West Indies and Texas. It is known as a "sand-binder," so that, in Florida, it would be a boon for this purpose alone, but it is a splendid yielder of good honey besides. Stock will eat it, and it holds up its head when every thing else is burned up by sun heat. The term carpet grass, or, better, carpet weed, suits it admirably, for it covers the ground like a carpet. It grows only a few inches high, as might be supposed from its creeping habit. It is one of those plants which it will pay beekeepers to study.

CATCLAW—(*Acacia Greggii* Gray). Known also as paradise flower and devil's claws. The acacia-trees are most abundant in Australia and Africa; but 16 species occur in the Southern States, chiefly in Texas. Several species are valuable for both honey and pollen: *A. Greggii* Gray and *A. Berlandiera* Benth. are two of the most important honey-plants of Texas, and yield immense quantities of excellent honey that ranks with the best white honey of the North. While possibly it would not sell alongside of our clovers, yet in localities where it is produced it is praised very highly for table use, no honey being classed

higher except that from the "huajilla," which see.

The catclaw is a bushy tree with low-spreading branches, attaining a height of anywhere from 15 to 20 feet. It derives its name from the bushy and fuzzy blossoms suggestive of the furry coat of a cat, and the peculiar kind of claws or hooks, shaped

Catclaw leaf, twig, and blossom; life-size.

very much like the claw of a common house cat. If one tries to push through the bushes or among the branches he will conclude that, unless he "backs up," he may "remain hooked." Perhaps he will anyhow.

The illustration in the column above shows a small twig, life size. The leaves are small and in clusters while the blossoms have a cottony or downy look. One of the seed-pods, after the blossoms have been cast off, is shown at the upper left-hand corner of the plate.

The tree comes into bloom about the first of May, and yields honey for a considerable length of time before going out of bloom. In July there is a second crop.

Like the huajilla and mesquite it grows in the semi-desert regions of Texas and Arizona where it would be impossible to carry on farming without irrigation. There are vast areas in both States mentioned that will probably never be used for any thing more useful to man than catclaw, huajilla, and mesquite; so that the onward march of civilization will not displace these honey-trees with more profitable farm crops. We may reasonably conclude that catclaw will remain one of the permanent sources of honey supply.

We are not sure but it would pay to introduce these valuable honey-bearing trees in other semi-arid regions. It has been introduced into Southern Europe, whence large quantities of its flowers are exported to France and England. It is there known as mimosa.

CATNIP—(*Nepeta cataria* L.). Often called catmint. Flowers bilabiate, nearly white, spotted with purple. The late Moses Quinby once said that, if he were to grow any plant exclusively for the honey it produces, that plant would be catnip; and very likely he was not far from right. But as we have never yet had any definite report from a sufficient field of it to test it alone, either as to quality or quantity of the honey, we remain almost as much in the dark in regard to it as we were at the time he made the statement many years ago. Several have cultivated it in small patches, and have reported that in a state of cultivation it apparently yielded more honey than in its wild state, for bees were found on it almost constantly, during several months in the year, but rarely one gets a full load. It has been called "the bees' bar-room," as they are so constantly hanging around it. Yet no one, we believe, is prepared to say positively that it would pay to cultivate it for honey only.

CAUCASIANS.—See Bees.

CELLAR WINTERING.—See Wintering.

CELLS, QUEEN.—See QUEENS and QUEEN REARING.

CHUNK HONEY.—See "Bulk Comb Honey," under head of COMB HONEY.

CLOVER—(*Trifolium*). No class of plants yields more or better honey than the clover. When we say "clover" we mean the common red, common white, alsike, and crimson clover. Alfalfa, sweet clover, sainfoin, and pin clover we do not include under this head, because they belong to a different genus, and in one case to a different family. However, if we include all these clovers under one general head we might say that clover in its broadest sense includes a class of plants that yield by far the most and finest table honey in the world. Years ago, when we spoke of clover honey we had in mind the common white clover and sometimes a little red-clover honey mixed with it. But in later years alfalfa and sweet clover have come to be grown so largely in the West that our great source of table honey is not from white clover, but from alfalfa, sweet clover, and sage.

Some thirty or forty years ago a failure in a crop of clover honey was almost unknown. But during later years intensive agriculture has crowded the white clover out of our fields to a certain extent, and we find it now only in fence corners and in some stray pastures that have not been plowed up. In its place have come alsike and red clover; but during the last few years the farmers have begun to notice that some of their lands were what they call "clover-sick." Lands that formerly yielded clover in abundance would produce it only sparingly, if at all, during these latter years. In the meantime, they began to discover that alsike clover would grow where the red clover would not seem to do well. During the last two or three years the real reason for this has been discovered. It is now known that red clover will not thrive unless there is plenty of lime in the soil. In later years, the constant cropping of clover and other legumes has so exhausted the natural lime in the soil that red clover often does not grow as it did in former days, and the land was then considered to be "clover-sick."

Alsike clover can stand a much more acid soil than red clover, and for that reason has been taking the place of red clover all over the country. But the time will soon come, at the present rate, when the soil will be too acid for alsike. The obvious remedy, is, to put lime in the soil.

In general, we may say that, where sorrel or red-top is seen to grow, where alsike thrives better than red clover, it may be safely assumed that there is a lack of lime in the soil. It therefore behooves the beekeeper to look into this matter very carefully in his own locality at least; and if the farmers around him are not posted on this subject he should look the matter up, study the clover fields very carefully, and where he finds usual evidences of lack of lime in the soil he should induce his farmer friends to get in touch with the nearest experiment station to advise how much lime should be used. Sometimes 500 lbs. to the acre will suffice; but usually it will take 1000 lbs.; and sometimes 2000 to sweeten the soil so that clovers will grow as they should.

Again, the beekeeper should call the attention of his farmer friends to the part that clover plays in imparting nitrogen to the soil. If he does not already know it, explain to him that there are little nodules clinging to the roots of the clovers, and these nodules gather bacteria. These bacteria gather the nitrogen, and impart it to the clover and to the soil itself. If the farmer is not growing clover, particularly alsike, or if he says his soil is "clover-sick," it is to the interest of the beekeeper to inform him, in order that his bees may gather clover honey as in former days.

In one respect, at least, this lack of lime in the soil is helping out the beekeeper, because the farmer is putting in alsike clover to grow on land that would not grow red clover as formerly. If alsike would continue to thrive year in and year out on such land, when red clover would not grow, or at least not very satisfactorily, the beekeeper could have no interest in urging the use of lime in the soil to make it grow red clover, which only at certain seasons has its nectar accessible to honeybees. But the difficulty comes right here: The soil will continue to grow more and more acid until it will not grow even alsike.

We do not know as yet whether white clover can resist acid soils as well as alsike or not. Mr. Alva Agee, one of the best

A fine field of white clover in Iowa.

authorities on the growing of clover and liming the soil, says that white clover thrives best where blue grass thrives best, and blue grass loves a soil rich in lime. The natural inference, then, would be that white clover has been going out, not only because of intensive agriculture, but because the soil is becoming too acid for it to grow. We do know this: Years ago there was no difficulty in getting crops of honey from white clover. But in late years white clover for some reason has failed time and again, even when the season was favorable. This may be due to the fact that the soil is too acid for even white clover to do well. If this be the fact, and white clover seems to be our main dependent for clover honey, it would be well for the beekeeper to urge upon his farmer friends, if they are not already so informed, the importance of liming the soil, providing it is too acid.

Don't infer from what we have said that the land may be *too* acid in every case. There are certain sections of the United States where it has been discovered that clovers will not grow as formerly, yet there is plenty of lime in the soil, and, of course, no good would come from putting any more lime in the land.

WHITE CLOVER (*Trifolium repens* L.). In the northern portions of the United States we find white clover common in our pastures. It is honey from this plant which gives the name of "clover" to most of the honey bearing that name. White clover was at one time considered the most important source of honey in the United States; and in the central and eastern States it still holds first honors in spite of the fact that intensive agriculture has crowded it out of the pasture lands in some sections, and not leaving enough lime in others for it to find a foothold only in vacant lots, fence-corners, and roadsides. The failing of white clover from the pasture lands has been met by rapid counterspreading of sweet clover (*Melilotus alba*) over the country generally.

It was formerly supposed that the seed of ordinary field white clover could not be gathered. This is now known to be a mistake. White Dutch seed, probably a domesticated variety of common white clover, has been sold for years. If it is possible to take the seed of one, it certainly is possible to take the other, if they are one and the same thing.

Fortunately white clover or white Dutch is being sown very extensively on our lawns. Mixed with blue grass it makes a strong firm sod. It therefore transpires that many back-lot beekeepers located in our towns and cities are able to secure considerable

of this finest of all honeys—the honey with which all others honeys are compared. From the lawns, white clover works over into the highways, and from the highways back into the fence-corners and on farms.

RED CLOVER (*Trifolium pratense L.*). Red clover is pollinated chiefly by bumblebees, and is therefore called a bumblebee flower. This reciprocal relation will be made clear by a brief history of the introduction of red clover into New Zealand. There were neither bumblebees nor honeybees in those islands at the time of their discovery; consequently, when the colonists attempted to grow this valuable fodder

Common red clover.

plant it failed to produce seed. To remedy this difficulty about 100 bumblebees, belonging to three different species, were imported from Europe, and subsequently the red-clover heads became fertile. It seems to have been supposed that any bumblebee would answer for this purpose, as one of the species brought from Europe was *Bombus terrestris,* which has too short a tongue, and has formed the habit of biting holes in the corolla tubes and robbing the flowers of their nectar without rendering any service in return. After the holes have once been made, other insects, which are themselves unable to puncture the corolla, use them to abstract the nectar. Thus, so far as the red clover is concerned it would have been better if this bumblebee had never been brought to New Zealand. In the course of time this fact was learned by experience; and as recently as 1905 the New Zealand government wrote to an experiment station in Canada inquiring in regard to the bumblebees useful in pollinating red clover in that country. As has been pointed out by Dr. Graenicher, two of the common and hardy bumblebees (*Bombus Americanorum* and *B. fervidus*), which have tongues 14 millimeters long, would be well adapted for this work.

In a favorable season, when there is an abundant rainfall, and the flowers of the red clover are fully developed, a bee can not reach the nectar unless it has a tongue 9 millimeters long. As the tongue of the Italian bee is only 6¼ millimeters in length, the nectar is then wholly inaccessible to it. This has been the cause of much regret among beekeepers, for these flowers not only secrete nectar very freely but the nectaries are much less influenced by weather conditions than those of many other plants. Repeated attempts have been made to develop a permanent strain of red-clover bees; but all such attempts have proved unsuccessful. It is no easy matter to lengthen the tongue of the honeybee 2¾ millimeters. The production of a race of red clover with shorter floral tubes has also received consideration.

But the second crop of red clover usually has shorter corolla tubes, and occasionally in very dry seasons the tubes are so short that large yields of honey are obtained. G. M. Doolittle says that two or three times in thirty years at Borodino, N. Y., the red clover has been a very valuable source of honey; and that one year he obtained fully sixty pounds to the colony on the average. W. Z. Hutchinson stated that he remembered one year when his bees stored 500 pounds of pure red-clover honey, as surplus, in the section honey-boxes. It was when the second crop had been stunted by drouth. The blacks stored none of the honey, the hybrids stored a little, but the bulk of the 500 pounds was furnished by the pure Italians.

But undoubtedly the most remarkable illustration ever recorded of the correlation existing between the weather and the length of the corolla tubes of the red clover was observed by E. R. Root near Medina, Ohio. In 1906 there was almost a drouth during the latter part of the season at his north beeyard, two miles north of Medina. Adjoining this yard were several fields of red

Peavine, or mammoth red clover; life size.

clover, for the farmers were furnished with seed of red clover and alsike free of charge. Owing to the dry weather the corolla tubes of the red-clover heads were shorter than usual, and great numbers of bees were attracted by the nectar which was now within their reach. "When one of the farmers began to cut his red clover that season there came near being a bad stinging-fracas; for when the cutter-knives of the mower went through the field they stirred up the bees, with the result that they attacked the horses and the man on the mower. So greedily did the bees work on that field that it looked as though they were not going to let anybody cut off their honey-supply. Other farmers in the vicinity also had considerable trouble in cutting their red clover because the heads were so covered with bees."

Singularly enough, at Medina, and the south beeyard, only two miles away, there was plenty of rain. When he went over a big field of rank clover at his south yard, scarcely a bee could be found; while quite the reverse had been true the whole season on the fields at the north yard, where there had been a drouth. The clover at the home and south yard, by reason of the plentiful rains, had attained a rank growth. The corolla tubes were so long that the bees couldn't get any nectar from them, and consequently there were no bees on the heads. Thus two beekeepers living only two miles apart might have arrived at diametrically opposite conclusions as to the value of red clover as a honey-plant.

Though red clover secretes nectar very freely and continuously it can not be regarded as of much value as a honey-plant, since it is only rarely that the nectar can be reached by hive-bees. Nor is there much probability of a permanent strain of red-clover bees being developed. Honeybees require a great amount of stores, and are compelled to visit a great variety of flowers; and for this purpose a tongue of medium length (about 6 mm.) is more useful than a longer one. For if the tongue is very long, the nectar in flat wheel-shaped flowers can be sucked up only with difficulty and delay. The additional nectar obtained from long-tubed flowers, like the red clover, would not compensate for the disadvantages sustained. Taking all the conditions into consideration, both within and without the hive, the tongue of the honeybee as it exists to-day is much better adapted to the work to be done than any that can be produced by artificial selection. The only possibility, then, would seem to be the development of a race of red clover with shorter corolla tubes.

THE PEAVINE, OR MAMMOTH CLOVER (*Trifolium pratense perenne*), is the largest kind of red clover known, as its name indicates; and it does, many seasons, furnish a very large amount of honey. As a rule, however, like the red clover mentioned above, it is seldom visited by the common bees; but nearly every season it is visited more or less by Italians; which some seasons (where very large fields are near by) store remarkably large amounts of very fine honey from this one source alone. In bloom principally through the months of August and September, it is a very important honey-plant. Although the hay is hardly equal to that from common red clover, it is, perhaps, the best forage-plant known to plow under. Once well started it will grow on almost any soil; and let a good stand be secured and plowed under, the ground gets in condition to furnish a fair crop of almost any thing.

ALSIKE CLOVER (*Trifolium hybridum*), also called Alsatian or Swedish clover. This was formerly supposed to be a hybrid, since it appeared so nearly intermediate between the white and red clovers; hence it is named *Trifolium hybridum.* It is now known to be a distinct species.

Alsike yields fully as much honey, and of as good a quality, as the ordinary white clover; and since many soils have become too acid for the growth of red clover, alsike is now taking its place. It is also being sown with timothy. The greatly increased acreage of alsike has, to a great extent, in some places at least, made up for the loss of white clover which formerly was so abundant. In Michigan and some other States there would have been no clover honey had it not been for alsike. White clover has disappeared to a great extent; but alsike, which has been grown so generally, is yielding a large quantity of fine clover honey.

In the meantime, farmers have come to learn that alsike clover has a peculiar quality and food value to stock that the ordinary coarser red clover does not possess. The statement has been made by dairymen

over and over again, that, acre for acre, alsike will yield more milk or more butter than red clover or timothy hay. When the farmers over the country come to discover this fact, there will be, of course, increased acreages of alsike. It may, therefore, come to pass that acidity in the soil is going to prove a blessing in disguise; for after the soils have been brought back to their former sweetness, so that they will grow red clover, there is a possibility and even a probability that farmers will see that alsike is so much better that they will continue to grow it as they have grown it in the past when they could not grow the ordinary coarser red clover.

Another thing that has been discovered is that, if alsike is cut or pastured off just before it comes into bloom, it will give a crop of clover honey just when we are most in need of it. One of our leading honeymen said that this fact alone, learned at a convention, has been worth more than $50.00 to him.

The following from the United States Department of Agriculture, Bureau of Plant Industry, is so valuable that we give it entire.

Alsike Clover (*Trifolium hybridum*).—A perennial clover, intermediate in size and general appearance between the common red clover and white clover. The branching and leafy stems, while not growing as large as those of red clover, commonly reach a height of 18 inches, and even 3 feet or more on slough land. The fragrant blossoms have a pinkish tint, and furnish large quantities of honey, the plant being often sown for that purpose by beekeepers.

Distribution.—In general alsike clover will grow successfully where red clover grows, but is best adapted to a cool, humid climate. It produces maximum yields near the boundary lines between the United States and Canada, in the regions of the Great Lakes and the Atlantic and Pacific oceans. Is is also grown very succesfully in some of the irrigated Rocky Mountain valleys, and in certain portions of Kentucky, Tennessee, and other sections where red clover now fails to produce satisfactorily.

Soil Requirements.—The most suitable soil for alsike clover is a deep, moist, clay loam, with a high percentage of lime. Slough soils that have been deposited by the action of water are also well adapted to alsike. Good crops are also grown on sandy loam soils well supplied with humus, but this clover will not succeed well on dry, sandy, or porous, gravelly soils. It will succeed on soils too wet for red clover.

Sowing.—Like red clover, alsike clover may be sown either alone or in small grain crops in early spring in the North, and early spring or autumn in the southern regions. When sown in the spring in small-grain crops the common practice is to allow the action of the weather to cover the seeds. Very often, however, better results are obtained if the seed is given a slight covering with a smoothing harrow or weeder. When sown alone the seed-bed should be well settled and finely pulverized on top, and the seed given a light covering. On strong, moist soil it should be sown with a grass, such as timothy, orchard grass, or redtop, to prevent lodging. It matures about the same time as these grasses, and improves the quality of the hay. On lighter soils where the growth is not heavy, successful crops are grown when sown with a grain crop or alone. When sown alone for seed or hay from 5 to 8 pounds to the acre are usually required. When sown with a mixture of grasses the amounts vary with local conditions., but a fair average for most conditions is alsike 4 pounds, and timothy 8 pounds per acre, or alsike 5 pounds and 10 pounds of ordinary redtop seed. A favorite mixture in the southern tier of States is 5 pounds of orchard grass, 10 pounds of tall meadow oat-grass, 4 pounds of redtop, and 4 pounds of alsike. Some farmers use a mixture of red clover and alsike, since the latter is a perennial, and will cover the ground when the red clover runs out.

Alsike is often used to good advantage in pasture mixtures, especially on wet land and in regions where red clover is not successful. Where alsike is used for pasture exclusively for horses and mules, it sometimes causes a skin disease. When cut for hay it should be cut just after it has passed full bloom, and it should be handled the same as red clover.

SAVING THE HAY.

Raised for hay and honey, without any reference to saving the seed, it gives at least two good crops every season; in this case it is cut when in full bloom. In our locality it usually blooms the last of June, and sometimes furnishes considerable honey before the white clover is out. The hay is admitted by all to be equal to any of the grasses or clovers in use, while pasturage, after the clover is cut, is most excellent for all kinds of stock.

Its value for milch cows is shown by the following, taken from *Gleanings in Bee Culture,* Vol. XIII., page 161:

AS A FORAGE PLANT

it has no superior, producing a large flow of very rich milk. June 15th, when I shut the stock out of the alsike, I allowed them to run in a field of red clover that was just coming into blossom, and at the end of the third day the five cows had shrunk their milk to the amount of 9 quarts to the milking. Then, in October, to test it further for feed, as there was quite a growth of leaves on the ground I again allowed the cows in the field. You may imagine my surprise when I found, at the end of a week, they had made a gain of 10 quarts to the milking.

Millington, Mich. M. D. York.

SAVING THE SEED.

The seed is always saved from the first crop of blossoms, and it should be allowed to stand about two weeks longer than when cut for hay. If you wish to get a good price for your seed, it must be very nicely cleaned. It is thrashed out with a clover-huller, made expressly for clover seed, and then cleaned with a fanning-mill with appropriate sieves. Timothy seed is very nearly the same size, making it difficult to remove it all, unless by a fanning-mill having the

proper blast arrangement. As the alsike weighs 60 lbs. to the bushel, and timothy only 45, there is no great difficulty in doing it effectually.

We need scarcely add, that whoever raises seed for sale should exercise the most scrupulous care to avoid sending out foul seeds of any kind; and where Canada thistles or weeds of that class prevail, we would, under no circumstances, think of raising seed to be sent all over the land. If they are in your neighborhood, raise hay and honey, and let seed be furnished by some one who is differently situated.

PROFIT OF THE CROP.

The seed has for a number of years sold for from $5.50 to $8.00 per bushel, and the average yield of seed is about four bushels per acre, 60 lbs. being reckoned as a bushel. It retails for 15 to 18 cents per pound.

The following, taken from *The Farmer,* of St. Paul, Minn., not only shows what profit may be realized in raising alsike, but is another proof of its value as a hay crop. The reader will observe that the writer is in no way interested in bees.

WILL IT PAY FARMERS TO RAISE ALSIKE WITHOUT ANY REFERENCE TO BEEKEEPING AT ALL?

About 20 years ago I bought my first alsike-clover seed, and sowed it alone on the south side of a hill. The season was dry, and it grew only about a foot high; and as it was said the first crop produced the seed, I cut it for seed and felt disappointed at getting so little that I was ready to pronounce it a humbug, and plowed it up the same fall. Some years afterward I saw a bushel of seed at the Dane County Fair, at Madison. I inquired of the owner, Mr. Woodward, how he liked it, and if it was a profitable crop. He said he got four bushels of seed per acre, and sold it at $10.00 per bushel; that the hay, after being hulled, was better than the best red-clover hay, and that his cattle ate it in preference to any other hay. I bought two bushels of the seed and sowed about one bushel to twelve acres, mixing one-third timothy, by measure, where I wanted it for pasture or for hay, and about the same quantity of pure alsike where I wanted it for seed. It does not raise seed the same year it is sown, but, like red clover, the next year. I have sown it with wheat, barley, and oats. It does best with spring wheat or barley.

I hulled 110 bushels this year from 20 acres. I expect to get $7.00 per bushel, and I have at least 25 tons of good hay, after hulling, worth enough to pay all expenses of cutting and hulling. Some years ago I sold my whole crop on the Board of Trade in Chicago for $11.00 per bushel.

Mr. George Harding, of Waukesha, a breeder of Cotswold sheep and short-horn cattle, and also one of Wisconsin's most wide-awake farmers, showed me a small field of one of his neighbors that he said produced seven bushels of alsike seed per acre, and that he sold it in Milwaukee for $12.00 per bushel. I have 80 acres in alsike; and so long as it pays me as well as it has done, I will sow it.

The first crop the next year after sowing is the seed crop. It can be cut for seed for several years. It is not a biennial plant like red clover, but a perennial. It has one tap root with many branches, and does not heave up by frost, like red clover, which has but one tap root.

I prefer it to red clover for several reasons. When sown with timothy it matures with it. (Medium red clover matures before timothy is fit to cut.) I cut about the 10th to 15th of July; red clover should be cut (here) about the 20th of June. Alsike is not easily injured by dew or light rains after being cut. It has none of the "fuzz" that red clover has, making it so unpleasant to handle as hay or seed. The stem is not so coarse nor so hollow, and has more branches, leaves and blossoms. The blossom is of a pink color. Red clover must be cut when we are in the busiest time working our corn. Alsike is cut after corn work is over. This is a great advantage in a corn region.

Alsike makes a good fall pasture after the seed is cut. My stock will eat it in preference to red clover, timothy, or blue grass. Blue grass, or, as it is often called in this country, June grass, is a good early and late grass, but in midsummer it dries up; and had it not been for clover we should have been badly off for pasture this dry year.

Dane Co., Wis. (HON.) MATT. ANDERSON.

FURNISHING SEED TO THE FARMERS.

The next, from *Gleanings in Bee Culture,* Vol. XIV., page 327, is of so much importance in regard to raising alsike, or other honey-yielding plants, that we give it here entire:

A SUGGESTION TO BEEKEEPERS IN REGARD TO HAVING ALSIKE RAISED BY THE FARMERS OF THEIR OWN NEIGHBORHOOD.

I have managed to supplement the natural supplies for my bees during the last five or six years as follows: I first tried sweet clover with but poor success, so I took up alsike clover, and this is the way I work:

About this time of the year I buy from 200 to 400 lbs. of best alsike clover seed in Montreal at wholesale price. This year I can get it for 12 cts., perhaps less. I expect to buy my supply next week. It will cost me ½ cent freight and I shall probably sell it to the farmers who are *within two miles of my apiary,* for 10 cts. per lb. At this price it is readily taken up by all who are "seeding down" land suitable for alsike, as the price in the stores here is from 16 to 18 cts. Three pounds mixed with timothy will seed an acre very well, so you see I get pasturage which will last from two to five years, of the very best quality for honey, at the small cost of $7.50 for one hundred acres. I can not conceive of any plan which, with me, would be cheaper, less trouble, or that would give as quick and reliable returns. I could get a good deal of seed used by selling it at cost; but I find that taking off two or three cents per pound makes a great difference in the amount sown. As white and alsike clover are the most reliable honey-plants we have here—very rarely failing entirely—the results have been very marked and satisfactory.

To those who wish to try this plan I would say: Work up the matter personally, canvass every farmer within two miles and more in every direction from your apiary (those living more than two miles should pay cost of seed), showing them a sample of your seed, pointing out its advantages, etc. Although alsike-clover hay will not weigh so heavy as red clover, it is far sweeter and better, and all stock much prefer it to eat. One pound of seed, also, will go as far as two pounds of red clover, as the seeds are so much smaller.

Canvassing the farmers should be done *at once,* as every good farmer plans his work and buys his

seed early. After you have finished canvassing, add up your orders, send to a reliable seedsman, distribute, and get pay for your seed, and your work for the season is done; but it should be repeated every season, to enlarge your "base of supply" as much as possible. Of course, you will have to wait one season before the alsike will bloom.

In localities where different apiaries are near together, if the seed is furnished under cost the parties should make up the amount of the difference *pro rata*, according to the number of colonies they have.

A WORD OF CAUTION ABOUT SOWING ALSIKE.

First, get the *very* best seed you can find. Poor seed is an abomination. Don't sow it on dry, sandy land, for alsike delights in a moist soil.

This simple plan of increasing pasturage may not be new, but I never heard it mentioned, though doubtless some have tried it.

Danville, Quebec, Can. GEO. O. GOODHUE.

We need hardly add, that the above plan can be carried out with buckwheat, rape, and any other honey-yielding plants that are of value to farmers.

Some beekeepers are beginning to find that it pays to furnish alsike-clover seed free of charge to their neighbors within a mile or a mile and a half of their beeyards, because, they aver, when the seed is once in the soil the plant continues to reseed itself so it will spread all through the farming country, both to enrich the farmer, giving him a better quality of hay when mixed with other clovers and timothy, and at the same time increase the annual honey crop of the beekeeper. One or two years after the free giving of seed, the farmers will begin to find out its value, and will then want it and be willing to pay for it. Some beekeepers then furnish it at half price.

So excellent is the quality of the hay that many farmers grow alsike year after year, notwithstanding that red clover or peavine yields a larger tonnage, but not necessarily more milk or cheese per acre. It is in such localities that an increase of the annual honey crops is noted.

Mr. Wm. McEvoy, one of the most extensive beekeepers of Ontario, finds it profitable to furnish seed to his neighbors. He writes in *Gleanings in Bee Culture* for March 1, Vol. XXXIV:

HOW CAN WE SECURE MORE HONEY OF THE BEST QUALITY? ALSIKE CLOVER VS. ALFALFA.

This is the all-important question, and I am well aware that nearly every one, if he answered, would say, "By increasing and moving the bees to where they can gather honey from clover." This can be done; but will the increase of bees not lead to encroaching on other beekeepers' rights? It certainly will if the parties moving bees from place to place do not provide for their share of the pasture. Almost any locality can be made a good one by seeding down 20 acres each year for three years with alsike clover. I am going in for increasing, and starting out-apiaries in places where no bees are kept, and will supply enough alsike-clover seed to seed down 20 acres each year for three years. It will cost me about the price of 300 lbs. of extracted honey each year; and for this little outlay I shall be immensely paid with a fine quality of the best honey.

Woodburn, Ont., Can., Feb. 12, 1906.

Following the practice of Mr. McEvoy, we have for several years been furnishing alsike clover seed to farmers at half price providing that the fields where it was to be sown were within half a mile of some one of our yards. We have also furnished it free to those who would sow it in fields within a few rods of the yards.

By continuing this policy we have enormously increased the alsike-clover acreage within half a mile of our yards. Our men observed that the amount of clover honey gathered has noticeably increased, and that less feeding of sugar syrup in the fall has been found necessary. After the alsike is once introduced it will keep on self-sowing, and, what is more, the farmers will discover that it will take root where the ordinary red clovers fail to make any satisfactory showing. Whenever the ground becomes "clover-sick," or whenever there is any ground on which ordinary red clovers do not seem to make a satisfactory growth, the alsike will usually do much better because it grows better in a more acid soil than red clover. Farmers all over the country are beginning to learn the value of this forage-plant, particularly when sown with timothy.

After a few years it will not be necessary to furnish seed free and at half price, for the farmer will find the crop so valuable that he will pay full price for it; but he must be educated at first by giving him a bonus.

WINTER-KILLING AND ITS EFFECT ON THE CLOVERS.

There are two kinds of winter-killing. One is known as the "heaving-out" process, by which the alternate freezing and thawing of a water-soaked soil breaks the roots of the clovers, dismembering them until there seems to be but little of them left. The other kind of winter-killing is from what might be called the dry process. In this the ground is frozen to a great depth, freezing the roots and plants solid. While it may thaw and freeze somewhat, it is claimed "that the severe cold wind blowing

over the surface when the ground is not protected, if it continues for any length of time, will kill almost any clover." It follows that, when the ground is covered with snow for most of the winter, clover suffers little or no damage.

But on the other hand it is claimed that white clover suffers less from winter-killing than any of the clovers. Unlike the common red, peavine, and alsike, it has no great tap-root. It is essentially a vine like the strawberry, having shallow roots at frequent intervals shooting down into the ground for short distances. During the heaving process of winter-killing, the white clovers are lifted up and down, and apparently are but little harmed by the process except in cases where there is very severe cold without snow that attacks root and branch alike.

THE EFFECT OF DROUTH AND WINTER SNOWS ON THE CLOVERS.

One authority says the drier it is in the fall, up to a certain limit, and the more prolonged, the more the root system is strengthened and the more it grows. If this drouth is followed by winter or spring rains, plants will grow amazingly.

Nearly all the writers agree that clover has freaks of yielding enormously some years and failing almost entirely in others. Some of them assert that a drouth in the fall is not hurtful, but beneficial, providing *other conditions that follow* are favorable. Others assert that a severe drouth in the fall is invariably followed by a failure of clover honey the following year, and there is considerable proof to support the statement. All acknowledge that a drouth may be so severe that the clover may be killed and is killed.

Some years ago a prominent writer made the positive prediction that we could depend on a crop of honey from clover if we only have deep snows in winter. Referring to this, one beekeeper says, in the winter of 1907 there was comparatively little snow, and yet there was a bumper crop in the summer of 1908; and then he adds, "As an actual fact, the amount of clover honey is not measured by the quantity of bloom; for I have seen the fields white with an abundance of it, but only a fair crop. I can remember one year when we had a great scarcity of bloom, and yet we had a good crop of clover honey. I have also seen fields white with clover, but no honey." He then goes on to say that he has seen the clover parched by drouth in June—not a blossom in sight, and at the very time of year when there should be bloom if ever. Then a series of soaking rains came on, and, presto! bloom and a crop of honey. He winds up by saying, "In the fall and latter part of the summer of 1897 or '8 we had a very dry time—not so dry as last fall, but dry enough —so dry that it was spoken of as being remarkably so. I had a bumper crop the following summer."

Another writer, Mr. John McLauchlan, of London, Canada, confirming the quotation just made, says:

> The fall of 1899 or 1900, I forget which, was exceptionally dry in this district right through from August 15 until winter set in. This was followed by a very dry spring with very little grass of any kind until the latter part of May, when a series of warm rains commenced which continued almost daily until about the 20th of June. The effect was marvelous. By the end of June the fields and roadsides were one beautiful mass of white clover and alsike, and the honey crop was the best my memory can recall.
>
> JOHN MCLAUCHLAN.
>
> London, Canada, Feb. 22.

Mr. E. Lamont, of New Dover, Ohio, says: "Late summer and fall drouths, as a rule, harm clovers but little. . . . I doubt if, in the long run, the conditions brought about by last year's dry spell are a damage to the beekeepers of the white-clover districts;" and then, implying that a wet fall is too much of a good thing, he adds: "I am satisfied that a rank growth of clover at any time, except white clover, does not yield the nectar that it otherwise would. This is proven conclusively in the case of red and alsike clovers that are cut for seed, as there is never so much seed on the low ground, where the growth is rankest." And then he concludes by saying that he believes it is an advantage, in point of nectar secretion, that clovers should have an occasional setback by drouth.

CRIMSON CLOVER (*Trifolium incarnatum* L.).—Sometimes called Italian or carnation clover. Grown in middle and southern States, but not hardy north. This species, if grown largely, would certainly have one special advantage over any of the other clovers, in that it comes into bloom before any other, and very soon after apple-blossoms; in fact, it fills the gap between apple-bloom and white clover. The color

Crimson clover.

of the bloom is quite distinct from that of the common red clover; in fact, it looks more like a great tapering strawberry than any thing else. Almost every season, while ours is in bloom, people stop their teams and look at it and inquire about it; and on Decoration Day sometimes they come for miles just to get huge bouquets of these great crimson blossoms that almost startle one by their beauty and brightness. In visiting other beekeepers where they have succeeded in growing it, we found a similar re-

port; and one who has never seen an acre of crimson clover in bloom can scarcely comprehend the beauty, not only of its gorgeous blossoms, but of the beautiful bright-green foliage which, with the color of the blossoms, distinguishes it from any other plant.

While this variety is not exactly new, the idea that it can be sown during July or August, and yet winter over as far north as the State of Ohio, is a comparatively new discovery. In States south of the Ohio River it may be sown in September, October, and even November. In our locality we obtain excellent results by sowing it the same time we do buckwheat (for particulars see BUCKWHEAT); or it may be sown with all sorts of garden crops, especially those that are to come off soon, all through the months of July and August. With very favorable fall weather it may succeed, or partially succeed, through the month of September. Some of our best crops have been secured by broadcasting it among early corn, just before it is cultivated the last time. If you want to raise some nice turnips, without any additional expense, mix thoroughly an ounce of turnip seed with 5 pounds of crimson clover before the clover is sown. In sowing it among corn, as mentioned above, we use a broad-cast seed-sower, the operator sitting on the back of a horse so as to get him above the tops of the corn.

SOWING CRIMSON CLOVER IN THE SPRING.

As the clover is a hardy cold-weather plant, sowing it in the spring is not, so far as we can learn, a success. The trouble is, when put in in the spring, even if put in quite early, the blooming time is quite apt to come just when the weather is hot and dry; and a drouth is almost sure to cause failure. If, however, the seed is put in quite early, and the spring months happen to be cool, with plenty of rain clear into July and even August, it sometimes makes an excellent crop. When sown as above, it naturally makes a large amount of feed, equal to any of the clovers; and some of our experiment stations have estimated that a good stand plowed under while in bloom is equivalent to ten tons per acre of the best stable manure.

As it comes in bloom a little before any of the other clovers (when wintered over), it may be plowed under for almost any crop. On our grounds we sow regularly four or five acres each year, and have had no failure. It is no more than fair to state, however, that in our locality, the northern part of Ohio, there have been many failures. In fact, one of our standard writers on agriculture says thousands of dollars have been wasted by farmers trying to grow crimson clover. The reason of our success is, we think, first, our ground is all thoroughly underdrained; second, it has had large amounts of stable manure, and is comparatively rich. The best stand we ever had, we think, was in the spring of 1899. We had several acres of wheat last year that lodged badly. The consequence was, enough wheat rattled out and was left on the ground to make pretty thorough seeding. This wheat grew up in the fall so rank as to fall down before winter. Well, the crimson clover was sown right on the wheat stubble in August; and when the wheat fell over, the clover pushed up through and was thus well mulched through the winter. The consequence is, we have at the present writing, April 25, a tremendous growth of clover and wheat together. This we propose to turn under as soon as the clover is in full bloom—say the middle or latter part of May. We have grown excellent crops of potatoes on crimson clover turned under in this way, for several years past; and, in fact, we have secured a splendid stand of crimson clover by sowing it after potatoes were dug that were planted comparatively early. One year we sowed crimson clover as fast as the potatoes were got out of the ground; that is, as fast as we dug fifteen or twenty rows we worked up the ground with a cutaway and Acme harrow, and sowed the clover. The first put in (in August) wintered splendidly. That put in along the fore part of September did fairly; but where we did not get the seed in until the last of September or fore part of October, it was mostly a failure. Perhaps one other reason why we succeeded is that our seed of late years has been of our own growing. It is an easy matter to grow seed; and where it is worth only $2.50 a bushel, the present price, we think the seed can be grown profitably in our locality—that is, on good ground with the conditions mentioned.

Later.—At this date (August, 1912) crimson clover has not come into general use.

QUALITY OF CRIMSON-CLOVER HONEY.

The quality of the honey from crimson clover ranks fairly with that of any of the clovers. Some have called it superior. There has not been enough of it in our locality to make a perceptible difference in the honey-yield; but when in bloom there are as many bees on the same area as we ever saw, even in a buckwheat-field. As we plow it under while in full bloom, the bees are gradually crowded down to the last heads standing; and after the last head goes under, for some time there will be quite a lot of bees swarming over the ground, apparently wondering what has become of their abundant pasturage in so short a space of time. We have as yet had no reports, to our knowledge, from hundreds of acres or more in blossom at the same time, as is often the case with alfalfa, white clover, and sometimes red clover. A fair-sized apiary needs many acres of *any* plant to give a good yield of honey.

Another great advantage it has over almost every thing else for poultry is that it is green and luxuriant through the winter when almost every other plant is killed by the frost. If you want to give your poultry green feed, with but little trouble, get in crimson clover as soon as a crop is harvested.

SAINFOIN CLOVER (*Onobrychis sativa* Lam.).—This excellent farm crop has been grown for ages in Europe, and at the present day is raised very extensively, more particularly in England, France, and Belgium, where it is a standby. The name "sainfoin" literally means *healthy hay*, presumably because it does not bloat stock to which it is fed. It certainly makes fine hay —possibly the very best known. It also produces choice honey in liberal quantities—the honey almost identical with white-clover honey. Grown and cultivated very much as alfalfa is with us it has this difference—it is not suited to a semi-arid country. It has been grown quite successfully at the Ottawa, Ontario, experiment station, and throughout all Ontario. Sainfoin does not yield as much hay as alfalfa, being finer in the vine, and not so tall. It commences to bloom shortly after fruit-blossoms fall, and stays in bloom long enough to allow bees ample time to gather a crop. The blossoms do not come all together, but in succession, hence it is not practical to cut it just before blooming time, as is now done with alfalfa. It would seem to be a grand crop for those who raise fine horses and cattle, also poultrymen who feed cut clover. It is not likely it will ever yield so large a crop as alfalfa, but in every other respect it is probably superior.

PIN CLOVER (*Erodium cicutarium* L'Her.).—Also known as alfilarila, musk clover, stork's bill, heron's bill, and pin grass. Naturalized from Europe, and widely distributed; one of the leading honey and pollen yielders of California and Arizona. It is regarded as an excellent forage plant by stockmen, quite equal in feeding value to alfalfa, and probably more palatable, because much less woody in character. An analysis by the chemist of the Arizona Experiment Station shows it is quite equal to any clover for feeding purposes. It is being rapidly spread by the cattle in the extreme Southwest, for it is easily disseminated, and requires no particular cultivation. In this respect it resembles sweet clover; but animals do not have to be educated to eating it; on the contrary they are fond of it from the start. As a honey and pollen plant it ranks very high, both as regards quantity and quality.

For the consideration of alfalfa, also a clover, see ALFALFA.

COLOR OF HONEY.—See HONEY, COLOR OF.

COMB.—See HONEYCOMB.

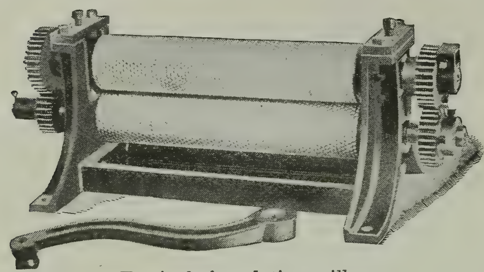
COMB FOUNDATION.—This is just what the term signifies—a base, midrib, or foundation of the honeycomb. If we take a piece of comb and slice it down on both sides, nearly to the bottom of the cells, we get what is practically comb foundation.

The article originally consisted of nothing but the midrib, without any walls; but very soon after, there were added walls to stiffen and strengthen the sheet and to serve as the beginning of the cells.

Since the introduction of foundation within the past few years, many difficult points have been solved, such as how to insure straight combs, how to insure all worker comb or all drone comb, as the case may be, and how to furnish the bees with the wax they need without being compelled to secrete it by the consumption of honey.

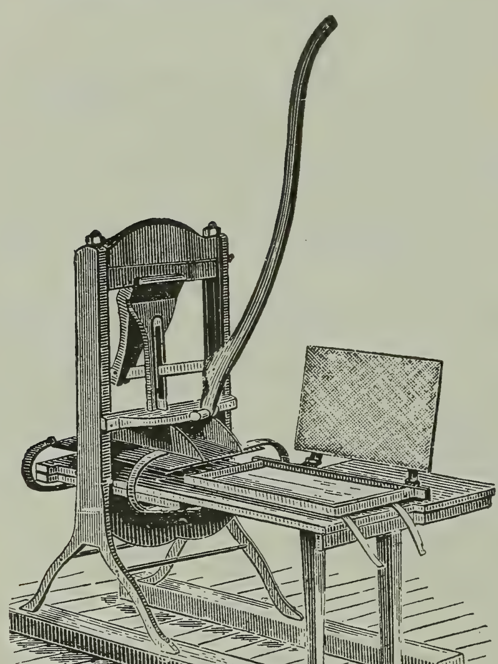
MACHINES FOR MAKING FOUNDATION.

There are two different and distinct classes of machines for doing this work. One consists primarily of two flat plates, or



Ten-inch foundation mill.

dies,* operated by a press. The other is made up of a pair of rolls having embossed surfaces and so adjusted, one above the other, that the die faces will mesh together. Through these, thin sheets of wax are run



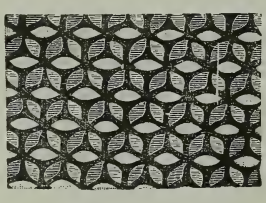
Given Foundation Press.

like clothes through a wringer. The first foundation-machines put out were presses with flat dies; but it was soon discovered that, in order to turn out foundation in a wholesale way, it would have to be done by means of rolls, for then the wax could be rolled out in continuous or long sheets, and the cost of production materially reduced. The cost of making by means of flat dies is so enormously increased that nearly all the foundation produced in the world is made on rolls. The best press that was ever so far made was the Given; but owing to the expense of making, and limited output, it can not now be obtained.

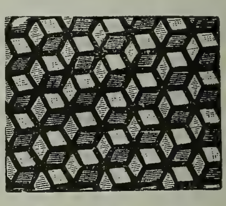
The making of foundation is almost a trade by itself. As full directions are prepared by the makers of foundation-machines we will not go into details here.

FOUNDATION AND ITS ECONOMIC USES.

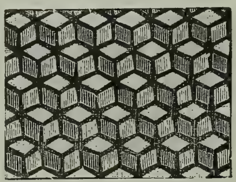
Comb foundation may be divided into two general classes: That designed for the brood-chamber and that for the supers, or where the surplus honey is stored. Each of these general classes is subdivided still further. For instance, we have what we call



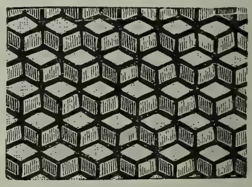
Heavy and medium brood



Light brood



Thin super



Extra-thin super

"thin super," running 10 to 11 square feet to the pound; "extra thin," 12 to 13; "light brood," used only in the brood-nest, running 8 to 9 feet; "medium brood," 7 to 8 feet. Thin super is generally used for sections, and medium brood for the brood-frames.

The four illustrations shown above represent the different grades. The medium had what is called the round cell. This foundation has been used for the brood-nest, because of its tendency to resist sag while the bees are drawing it out into comb;

* There is a machine sold in Germany (the Rietsche) that uses flat dies without a press. The dies are hinged together and open like a book. Hot melted wax is poured on the lower die, when the other die is brought down on to it like the closing of a book, before the wax cools. The product is very crude compared with that made off from rollers or a good press.

stronger, because there is more wax in the corners of the hexagons. It has been found that bees will utilize all this wax in the walls, and draw it out into cells. The more wax we can give them in the wall, the quicker will they draw it out into comb. The light brood has what is called the regular hexagonal cell-wall, and is now generally used for the brood nest where frames are wired. As will be seen by comparison of illustrations, there is less of wax in the wall, and less strength to the sheet. On this account it is not recommended that light brood foundation be put into brood-frames that are not wired. The thin super has lighter walls still than the light brood; and the extra-thin super lighter walls still.

The ordinary thin super is generally preferred because the bees are less inclined to gnaw it down; and when they do begin work on it they draw it out more readily. The extra-thin is preferred by some because it is believed it makes less midrib in comb honey. When too heavy foundation is used in the sections, especially when full sheets are used, the resultant comb honey, when eaten, is quite apt to show a midrib, or thickened center, and some go so far as to call it manufactured comb because they can not believe that it is as thin and friable as the comb honey they ate "on the old farm at father's." There is some truth in this, and for that reason only thin super or extra-thin should be used; and when one desires as little midrib as possible, and does not care how readily the bees may accept and work out the foundation, the extra-thin super is the one he should use.

Owing to the tendency of foundation to cause midrib in comb honey, some think that using a starter would remove the objectionable feature. They argue that nearly all the comb would have to be natural, and it would, therefore, be delicate and friable like the old comb honey on the farm. But it has been shown in the majority of cases that the natural-built will be *store* or *drone*, the cells being larger so the bees can build them more readily. Some recent tests seem to show that natural-built *drone* comb has much or more wax to the cubic inch than worker comb built from full sheets of thin worker foundation. If the bees, on the other hand, would make their natural comb *all worker*, then we should have a comb, the delicacy and friableness of which would be all that we could desire. Drone-comb cappings do not have nearly the pleasing appearance of worker. If for no other reason, full sheets of worker foundation should be used.

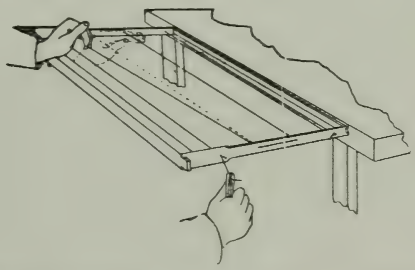
5

FLAT-BOTTOM FOUNDATION.

Flat-bottom foundation has been made, which some think is the best surplus foundation. It is nothing but a sheet of wax, embossed with hexagonal cells inclosing a flat base. While it makes very nice comb honey, yet the testimony of many of those who have tried it is to the effect that it is not readily accepted by the bees, and consequently valuable time is lost. We do know this much, that they remodel and rebuild the cells before drawing them out. There is so little demand for it now that its sale has been discontinued.

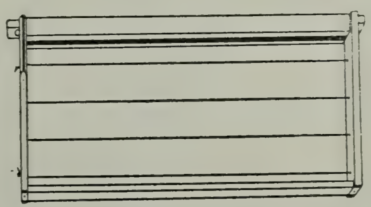
FASTENING FOUNDATION IN BROOD-FRAMES.

Some beekeepers secure the foundation to the top-bar without using any stays or



Method of drawing the wire preparatory to fastening

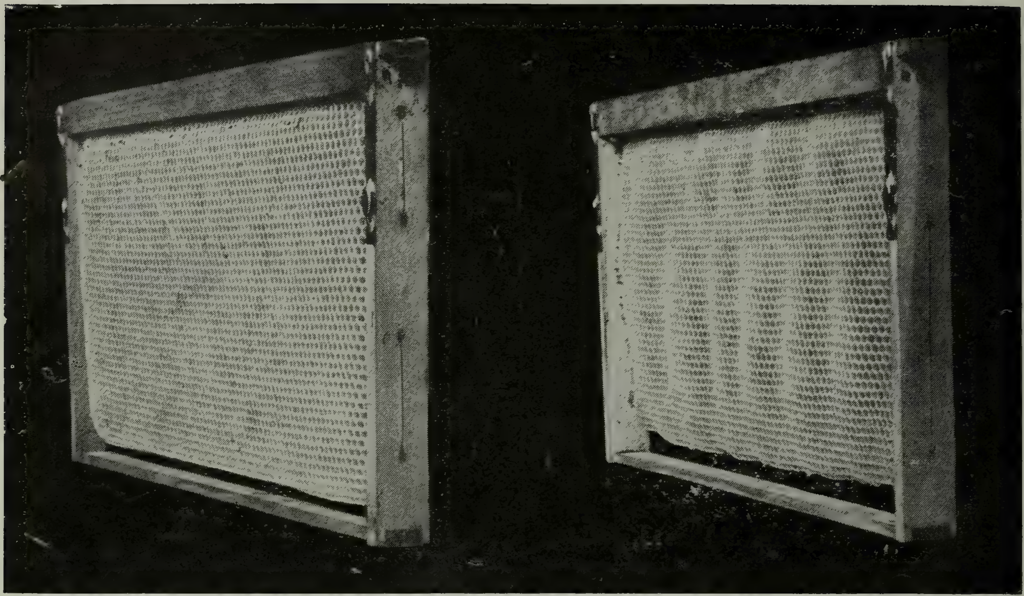
wires to hold the sheet in place; but the great majority seem to prefer to have all their frames wired—that is to say, strands of No. 30 wire stretched vertically or hori-



Brood frame horizontally wired.

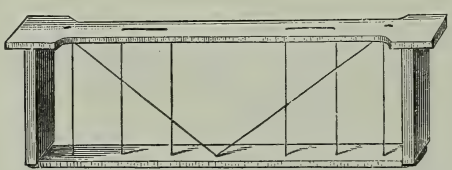
zontally across the frame; these are then imbedded into a sheet of foundation which fills the frame. The combs, therefore, are firmly anchored in place to stand the rough usage of the extractor, for shipment of colonies on them by express or freight, or hauling over rough roads to outyards.

Most beekeepers say that the expense of the wiring is so slight in comparison with



Horizontal and vertical wiring compared. Note that the comb at the left, built from horizontally wired foundation, is perfect except for the slight sagging. The comb at the right, built from foundation reinforced with seven vertical wires and two horizontal wires, is very irregular.

the great benefits secured that they could not think of dispensing with it; and, what is of considerable importance, during the process of drawing out the foundation the wires tend to reduce materially the stretching of the wax; and such stretching, unless restrained by stays of some sort, results in elongated cells in which the queen will lay drone eggs, or she will not lay at all. This one item alone pays for the expense of wiring. The usual method is to pierce the end-bars about two inches apart, threading the wires through these holes back and forth as shown in the illustrations on the previous page. The sheet of wax is then laid and wires imbedded as shown on following pages.



While this is the usual method, some prefer *perpendicular* wiring, arguing that the horizontal strands are liable to sag to some extent, allowing a slight stretching of the wax. If the top-bars are thin the wires are threaded through the top and bottom bars, when the process of fastening the foundation is the same as before described.

It is true that the vertical wiring permits of a thinner and therefore cheaper grade of foundation; for when the horizontal strands are used, nothing lighter than those known as light brood should be used, running from 9 to 10 sheets, Langstroth size, to the pound.

But there are two difficulties in wiring frames perpendicularly. One is the thickness of the top-bars and the other is the tendency of the foundation to expand between the vertical wires. The only practical way to use them in thick-top frames is to use staples driven on a medial line on the under side of the top-bar and the top side of the bottom-bar. But as these interfere with the double-wedge-and-groove plan, which has come to be so popular among beekeepers, vertical wiring of thick-top frames has not come into general use. The other objection is the tendency of the foundation to expand between the lines of support. This will be better understood by referring to the illustration shown at the right. The frame at the left is wired with four horizontal wires, while the one at the right has five vertical wires and two horizontal ones. Notice how the foundation is bulged out between the vertical wires. This, of course, would make the combs somewhat wavy, and therefore, to a certain extent, imperfect. While foundation expands in

drawing out the comb between horizontal wires, the wires themselves sag just enough to take up this expansion, and therefore it does not show. See illustration at the left. At the present time, it seems more feasible to use a heavier grade of foundation, using horizontal wires, than to attempt to use vertical wires, especially when it is so difficult to fasten them to the top-bar and bottom-bar when the top-bars are thick.

The elongated cells complained of in horizontal wiring usually take place, not while the foundation is being drawn out, but a year or so after the combs have been in use. It appears that a slight stretch takes place after the combs are filled with honey; and the weight of the honey during hot weather has a tendency to stretch the cells somewhat, making them somewhat elongated near the top.

THE WOOD-SPLINT PLAN.

Dr. C. C. Miller, of Marengo, Illinois, has overcome the difficulty of fastening vertical wires to the top-bar by using wooden splints instead of wires. These he secures in the manner described in his "Fifty Years Among the Bees."

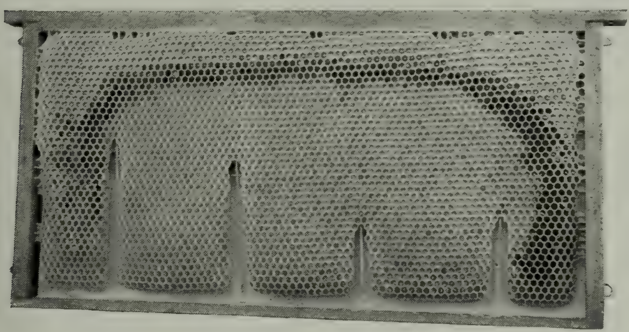
The splints should be about 1-16 inch square and about ¼ inch shorter than the inside depth of the frame. A bunch of them should be thrown into a square shallow tin pan that contains hot beeswax. They will froth up because of the moisture frying out of them. When the frothing ceases, and the splints are saturated with wax, they are ready for use. The frame of foundation is laid on the board as before. With a pair of pliers a splint is lifted out of the wax (kept just hot enough over a gasoline-stove), and placed upon the foundation so that the splint shall be perpendicular when the frame is hung in the hive. As fast as a splint is laid in place, an assistant immediately presses it down into the foundation with the wetted edge of a board. About 1½ inches from each end-bar is placed a splint, and between these two splints three others at equal distance. When these are built out they make beautiful combs, and the splints do not seem to be at all in the way.

A little experience will enable one to judge, when putting in the splints, how hot to keep the wax. If too hot there will be too light a coating of wax.

It must not be understood that the mere use of these splints will under any and all circumstances result in faultless combs built securely down to the bottom-bar. It seems to be the natural thing for bees to leave a free passage under the comb, no matter whether the thing that comes next below the combs be the floor-board of the hive or the bottom-bar of the frames. So if a frame be given when little storing is going on, the bees will deliberately dig away the foundation at the bottom; and even if it has been built down, but the cells not very fully drawn out, they will do more or less at gnawing a passage. To make a success the frames should be given at a time when work goes on uninterruptedly until full-depth cells reach the bottom-bar.

Under some conditions the bees will gnaw around the wooden stays, as shown by the illustration. This occurs more particularly when bees have not much to do; and when they run across any thing which is fibrous they will at such times show a disposition to remove the object.

The suggestion has been made that in no case should the splints be allowed to project beyond the edge of the foundation; or, better still, the sheet should reach clear to the bottom-bar.



In some cases wooden splints are gnawed by bees.

But we see no reason why the foundation should not expand between the vertical splints the same as it expands between the vertical wires. While Dr. Miller says that he has had no trouble of that sort, it is because he uses foundation heavy enough so that he overcomes this stretching or expanding. As the wooden supports prevent the sagging of the foundation or the comb only after it is drawn out, and do not secure the comb to the frame, it may be a question whether it is not safer and more satisfactory all around to use four horizontal wires, especially if one is going to do very much extracting or intends to ship or move bees to any extent.

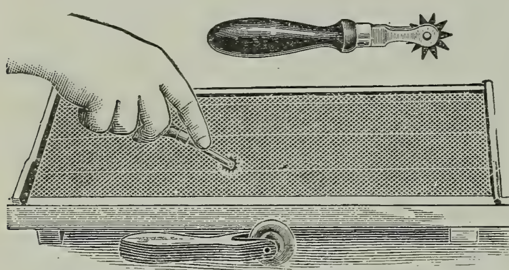
PAPER AS A BASE FOR FOUNDATION.

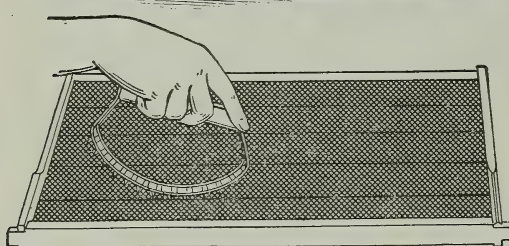
Other devices have been used, such as paper imbedded in the center of the foundation; but this is very objectionable because the bees soon discover that this is a foreign substance, and proceed to tear out the paper bit by bit, utterly ruining the foundation. They do not *always* do this; but sooner or later they will; when they have nothing else to do they will begin to tear out the paper, imagining, perhaps, that

the fiber is a part of the silken gallery of the moth-worm.

IMBEDDING THE WIRE.

Various methods of imbedding the wire have been used; but one of the simplest is the tracing-wheel to which allusion has already been made.





THE EASTERDAY.

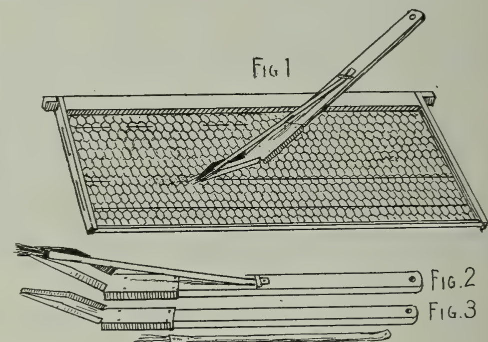
A much better tool, because it has a much larger arc of contact, is the Easterday.

IMBEDDING WITH HOT WAX.

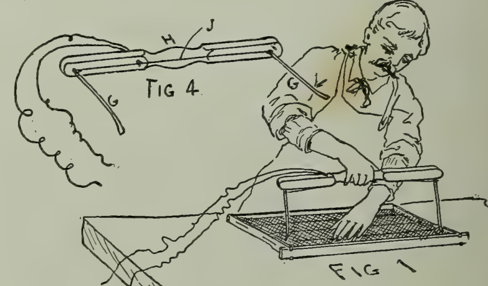
Mr. E. F. Atwater, of Meridian, Idaho, always waxes over the wire when it is imbedded. Since too much wax would be deposited along the wire if he used a spoon or regular wax-tube, and since a brush will not hold enough wax at a time to do fast work, he combines a brush and home-made spoon as shown in the following illustration.*

IMBEDDING WIRE BY ELECTRICITY.

The following plan will give altogether the best results providing one is ingenious enough to handle an electric current, either from batteries or from electric-light circuit. If a wire is too small to carry a given current of electricity, it will heat; and if the current is too great, the wire will melt. Taking advantage of this principle we can, with a proper amount of current, cause the wires to heat to a temperature of, say, 130 degrees Fahr., at which point they will, when properly applied, sink into the foundation; then when the current is cut off, of course the wires will cool immediately, and lie imbedded in the center of the sheet of wax. With ordinary batteries it is not practicable to heat all four of the wires at a



time. Accordingly the average person will have to heat one wire at a time, and this is done as shown in the accompanying illustration. Fig. 4 is a wooden handle, at each end of which are mounted two stiff wires, G G, flattened at the ends. To each of these is attached one pole of the battery. When the current is on, the points G G are pressed on the extreme ends of one strand of wire, while the free hand presses the sheet on top of the wire until it melts its way half through. The current is now broken



Electric imbedder in operation.

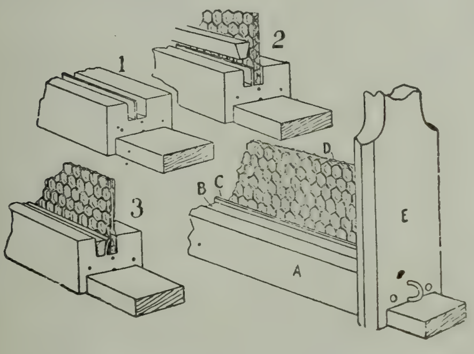
by lifting up the handle H. The other four wires are in turn treated in the same way. Six cells of ordinary dry batteries, *when new,* will do this very nicely. Old batteries, or those that have been long on the shelf of a store, are unfit for this use. They must be fresh from the factory where made.

* The most rapid and positive method is by drawing a hot iron along the wire. The iron should have a thin edge with a groove in it to run on the wire. A slight pressure beds the wire; and the hot iron, as it passes, melts a little of the foundation and cements the wire to it. A little experimenting will show how hot to have the iron and how much pressure to use. An old file makes an excellent wire-imbedder. The tail is filed to a quarter circle, and that has a groove filed in it, and is thinned so it will not melt the foundation too far from the wire. —A. C. M.

Where one has access to an electric-light current, by putting in sufficient resistance he can heat all four wires at a time, thus accomplishing the imbedding at one operation. The electrician at the power station or any one else who understands these light currents can easily arrange this resistance at small expense.

FASTENING FOUNDATION TO THE TOP-BARS OF BROOD-FRAMES.

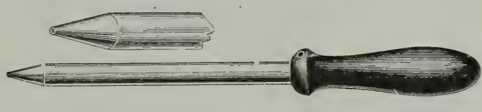
After the wires have been imbedded in, say, 100 frames, the top edge of the foundation is fastened to the top-bars, either with the Van Deusen wax-tube or double-groove-and-wedge plan shown next.



Wedge-top-bar method of fastening foundation.

Most of the supply-factories furnish these kinds of top-bars now because beekeepers generally prefer them. There is a double groove, one of which is in the center of the top-bar. In this groove is inserted the sheet of foundation, as at D. The wedge-shaped strip of wood B is then driven into the other groove as far as it will go, crowding the central partition firmly against the foundation. It is very important that it be *driven below the surface* of the wood, as otherwise it may work out, allowing the foundation to fall out. When the work is properly done it is thus held firmly in place without any special tools or fussing with melted wax.

There are a few who prefer the melted-wax plan of fastening foundation. Where the under side of the top-bar is plain without grooves or molded edge, this is perhaps the best. In the case of sections using full sheets, cut to a neat fit, it is the only method. The best tool for depositing a hot stream of wax along the edge of the foundation is undoubtedly the Van Deusen wax-tube fastener. It is simply a tube half an inch in diameter, six inches long, tapering, and at the apex a small hole. On one side is bored another small hole which may be opened or closed with the thumb. When the tube is stood up in a cup of hot wax the air will escape from the upper hole, and the wax flow in at the other small hole at the bottom. The thumb is closed over the upper one; the instrument is drawn out of the wax, and the point is then slowly drawn



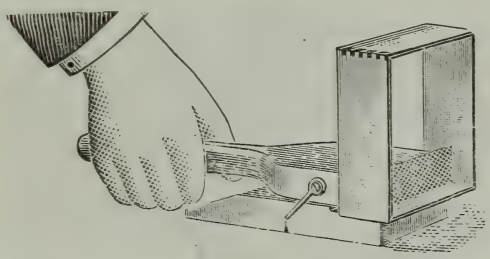
Van Deusen wax-tube fastener.

along the edge of the foundation in contact with the top-bar, leaving a fine stream of hot wax to cement it. While this is doing, the thumb should be lifted from the upper hole.

FASTENING FOUNDATION IN SECTIONS.

Thus far we have described methods and devices for fastening sheets of wax in brood-frames. What follows relates to the fastening of foundation in section honey-boxes.

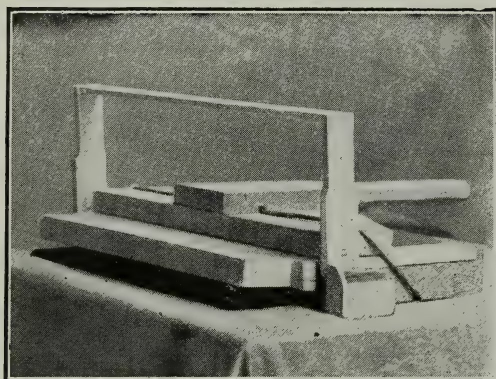
PARKER MACHINE FOR FASTENING STARTERS IN SECTIONS.



The principle of this machine is, to rub the edge of the wax into the wood of the section. The motion of the machine spreads the wax down, and mashes it into the wood. It is a very simple machine, and is used quite largely; in fact, many thousands of them have been sold. It does very nice work; but where thousands of starters are to be put in, it becomes a little tiresome on the hands, and besides is not as economical of foundation as the Daisy or Root foundation-fastener.

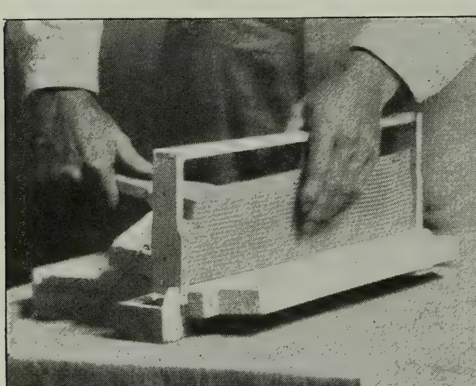
Mr. J. J. Wilder, of Cordele, Georgia, uses the principle of the Parker foundation-fastener in securing foundation to the top-bars of his brood-frames. The two accompanying illustrations will show the implement. Mr. Wilder prefers this plan to

the double-wedge-groove plan or the melted-wax plan. In the case of the former, he says it is very difficult to get the wax out of the grooves so as to secure the foundation



Wilder's fastener for securing foundation in shallow frames.

back into the frames. When running for bulk or chunk honey the combs are cut out of the frames and filled with foundation. If he uses the melted-wax plan, the sheets are apt to break off because the heated wax becomes hard and brittle. When the foundation is put in with a Parker machine, the

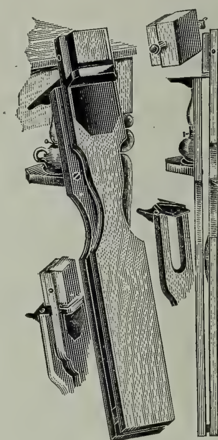


The machine in operation, showing that it works on the principle of the Parker foundation-fastener for putting starters in sections.

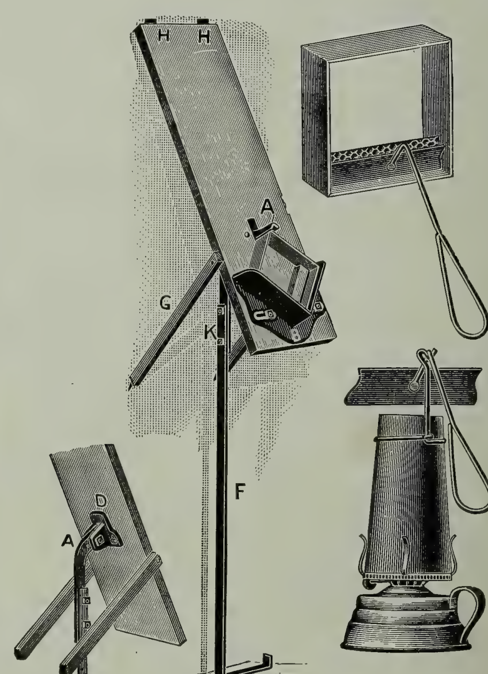
foundation, he thinks, is secured very much better. Where one produces bulk comb honey or chunk comb honey (see Comb Honey) this plan is to be preferred to any other method here shown.

DAISY FOUNDATION-FASTENER.

The principle of the machine is this: A metal plate or tongue is kept heated by means of a lamp beneath. This plate, by a slight pressure of the hands while holding the foundation, is made to pass directly under and come in contact with the bottom edge of the starter. Instantly the edge of the foundation melts; the pressure of the hands being released allows the tongue or plate to withdraw, and the starter is allowed to drop on the section, when it cools and is held firm. This method of fastening foundation is used very largely. Another method that seems to meet with a great deal of favor is a modification of the principle just shown; but in this case the



heated plate is mounted on the end of a wire handle. This plate is heated over a lamp, then applied against the bottom edge



of the foundation after it is folded and the starter is put in place. This makes the work more rapid, and, in the hands of the average person, it gives better results, for the complete outfit costs less than the others.

STARTERS V. FULL SHEETS FOR SECTIONS.

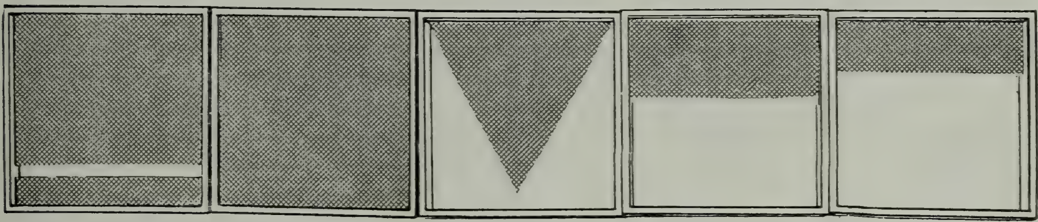
In the illustrations under COMB HONEY, showing the supers, only narrow sheets of foundation (or starters) are shown in the sections. The expert comb-honey producer will never be content with a starter. He will buy his foundation of such size that he can cut it to suit his own individual notions. Some of our comb-honey producers cut it in sheets one-fourth of an inch narrower and half an inch shorter than the inside of the section. It is then fastened to the top as shown previously, with any one of the several styles of foundation fasteners. Others cut the sheets in the shape of a letter V; still others use half a sheet.

But the great majority of producers prefer to use two pieces—a large one secured to the top and a strip about 5/8 inch wide fastened to the bottom. The larger sheet is so cut as to reach within 1/8 or 1/4 inch of the bottom starter when in place to allow for stretching.

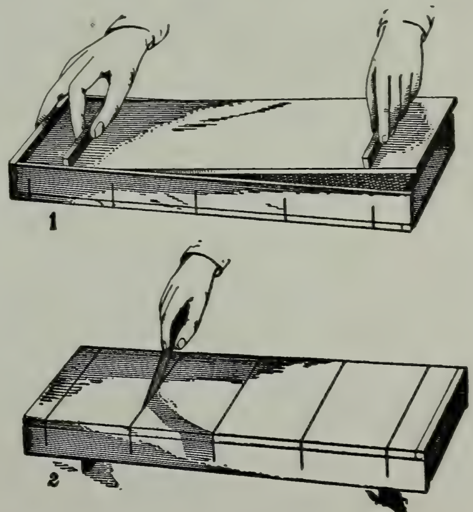
During the subsequent process of drawing out, the bees will make one complete comb, the same being fastened to the top and bottom. Where only a starter or even one large sheet is put into a section, the fastening will be at the top and part way down on each side; but when the bottom start r is used in connection with a large sheet of foundation, there surely will be a fastening at the bottom as well as at the outer edges. The result is a comb fastened to all four sides, one that is neater in its general filling, and, in consequence, will command a higher price; and last, but not least, a section that will stand shipping. A nice super of sections with combs not fastened at the bottom is liable to arrive at destination in bad condition—many of the combs broken out; and it is, therefore, always advisable to use a bottom starter.

A few beekeepers advise cutting the foundation so it will just neatly fill the section on all four sides. A section is then slipped over a block a little less than half its thickness so that when one of these just-right-size sheets of foundation is laid on the block, the foundation will be perfectly centered in the section. With the VanDeusen wax-tube shown on a previous page the sheet is then secured to all four sides by the stream of hot wax.

It has been found that very fine comb honey can be secured by this plan, the resulting sections having but few popholes. However, there are two disadvantages. For instance, some find it difficult to cut the foundation just the right size and still do the work rapidly. It can be seen at once that there must be but little variation in the size of the sheets. The best arrangement for cutting the foundation that we know of is the miter-box. This device can be quickly made by almost any one, the construction being plain from the illustrations. The box should be placed on a table with the saw-cuts down as in Fig. 1, and from five to twenty sheets of foundation laid in, care being taken to see that the ends are even. Then the cleated board should be put on top of the sheets of foundation, and the box



The different methods of cutting foundation for the sections.



The Yoder plan of fastening full sheets at the top and two-thirds of the way down the sides.

turned over so that it rests on the cleats, as shown in Fig. 2. For cutting, a keen-edged butcher knife should be used. It need not be hot, if kept well lubricated with soapy water. The knife should be held at an angle as shown, and moved rapidly but lightly back and forth, cutting only on the drawing stroke. If the saw-cuts are carefully spaced and the whole box put together in a square workmanlike manner, the sheets of foundation can be quickly and accurately cut.

Another disadvantage to the plan of fastening full sheets of foundation on all four sides is the tendency of such foundation to buckle, due to variation in temperature, etc. Mr. G. J. Yoder, of Meridian, Idaho, overcomes this buckling by fastening the full sheet of foundation only at the top and two-thirds of the way down each side. This plan has been tried quite extensively and found very successful. Mr. Yoder described his method fully in the April 1st issue of *Gleanings in Bee Culture* for the year 1908, and we herewith reproduce his directions as well as illustrations.

Cut a light board about three inches longer than the width of four sections, and just the width of the inside of the section. Now cut four square blocks of such a size that folded sections can slip over them and a fraction less in thickness than half the width of the section. Nail the first block 1½ inches from the end of the board, and place a section over it. Put block No. 2, with section over it, next to No. 1, and so on till all are nailed on. Make at least five or six of these forms with blocks on. Next make a trough the width of the board of the form without the section, and 2 inches deep, so the form will slip in easily to the depth of the blocks. I next melt some wax for fastening the foundation, using about one-tenth part of clean rosin, and have ready a wax-tube or teaspoon with the end bent in on both sides.

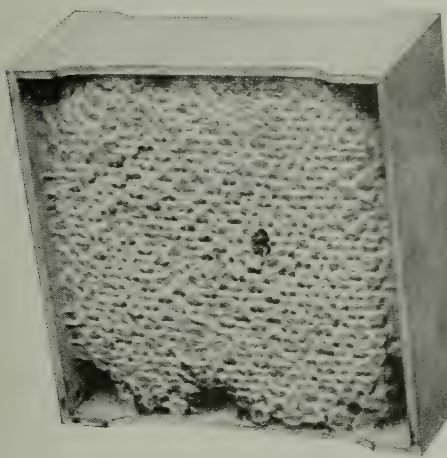
If possible, get the foundation cut by the manufacturer, so that all sheets will make a given number of uniform starters with as little waste as possible. The last three seasons I have been unable to buy starters cut just right, and so have had a loss of one-seventh of the foundation for the crop of 20,000 sections.

Put the sections on a form and spring the section-holder over them. This makes them square and tight. Place the foundation in clear to the top of the section. I prefer a ⅛ space between the lower end of the foundation and the bottom of the section, as this is just about the amount needed to take up any possible sagging, and to prevent the buckling of the foundation. Now grasp the form in such a way that the top part of the section is lowest, and apply the melted wax on the section at the edge of the foundation, turning the form so as to run the wax all around as far as wanted. If all four sides are waxed, the weather warm, and the honey coming in fast, there may be a bulge at the lower part of the section; so of late we prefer to cut the starter full size, ⅛ inch short at the bottom, and to wax the top and only two-thirds down each side. Lay this filled form down to cool, and take the next, giving the wax of the first four sections a few min-

utes' time to harden. Then place the form over the trough; press the tray down out of the sections, and you will have the wide frame of sections, and with the foundation ready for the super without danger of buckling. One of our men filled 3000 sections in a day.

COMB HONEY.—While all honey in the comb is what may be called "comb honey," yet the term as ordinarily used refers to small squares of comb, built into frames of wood technically called section honey-boxes, or "sections" for short; therefore all references to comb honey, whether in the market quotations or in the ordinary literature relating to bees is understood to apply to the article built in sections.

More lately, little chunks of sealed comb honey about an inch and a half square are being put up in paraffine paper, the whole slipped into a neat little carton. This is what is called the "individual comb-honey



service," and may be found in some of our high-priced restaurants, hotels, and dining-cars.

In the Southern States there is another article called chunk or "bulk comb honey." The combs are built usually in shallow extracting-frames, and cut out in various-sized chunks of a size that will fit tin buckets or glass jars. The spaces between the combs and around them are filled with a good quality of extracted honey. They are sealed or covered with the ordinary cover of the tin bucket. Bulk comb honey is produced very largely, particularly in Texas; and where bulk honey is sold, very little comb honey in sections is produced. Bulk comb honey has the advantage that it does not require as much skill to produce it as the ordinary comb honey in sections; neither is it necessary that every piece of comb be as perfect as to capping, filling, or shape. In localities where there is any suspicion of manufactured comb honey, bulk comb honey is readily sold. Generally speaking, its sale is confined to the Southern States—Texas and the Southwest, while in the North, and practically all the rest of the United States, comb honey is put up in sections.

The time may come, however, when consumers everywhere will learn to appreciate bulk or chunk comb honey, especially after they learn that it costs less to produce and at the same time retains all the fine eating qualities of the article in sections. The time may come, also, when cut comb honey wrapped in paraffine paper, and further protected with a neat carton, will take the place of section comb honey. There is no doubt that such honey will ship better than comb honey built solid in sections.

The greatest objection to the use of bulk comb honey in the northern States is the danger of the liquid portion granulating. When this takes place the whole would have to be melted up in a wax-extractor, even though the comb honey was not candied.

A few years ago, when the extractor was first invented, it was supposed that nothing but honey out of the comb would be sold, for the reason that it could be produced more cheaply. But our best connoisseurs now know that even our very best extracted honey seldom has the fine delicate aroma of honey that is held in the comb, just as nature gives it us. Honey in the comb holds the flavor and the delicate aroma from the individual flowers from which it was gathered much better than after it is removed from the comb. The flavors of honey, it is said, are made up of ethel alcohols that are very volatile. It follows that, when the honey has been removed from its original container on exposure to air, it loses some of its flavor, especially if it be heated to prevent granulation. See EXTRACTED HONEY, BOTTLING HONEY, and GRANULATED HONEY. If ever a majority of consumers prefer comb honey it will be because to them it has more flavor, and because, probably, the crushing of the delicate cells in the mouth gives the eater a certain degree of satisfaction because he has something to "chew." Extracted honey on the other hand is swallowed, while comb honey is masti-

cated, or "chewed" as food should be. Of course the little pellets of wax, after the honey has been eaten, are generally expelled. To some this very accumulation of wax in the mouth is an objection, and we therefore find there are many who prefer extracted honey, because they prefer to have something they can chew on bread and butter and biscuit, without having a "gob" of wax mixed in with the food.

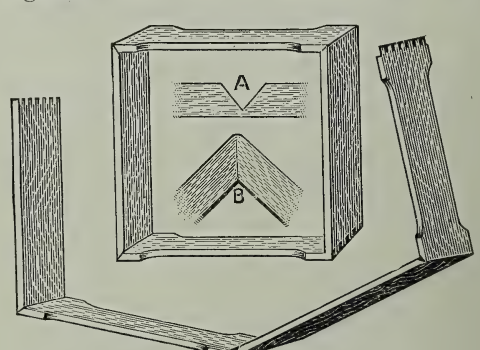
Unfortunately of late years, owing to the carelessness of producers in packing, many honey-dealers have refused to handle comb honey because of the amount of breakage and leakage. The result is that the demand for extracted has increased while the call for comb honey has become less and less. This is wrong. So long as it is admitted that comb honey has a little finer flavor than the same honey out of the comb, beekeepers should cater to the demands of all classes of consumers. When we remember that comb honey, as a rule, retails at twice the price of extracted, it goes to show that there are thousands and thousands of consumers who prefer honey in that form, even if they have to pay double price. It therefore behooves us to see that our shipping cases and comb-honey carriers are properly constructed in the first place. (See Shipping Cases for Comb Honey.

In the early '80's the statement was made that comb honey could be manufactured— "combs made out of paraffine, filled with glucose, and capped over with appropriate machinery." This canard went like wild fire over the country; and even to this day there are some who believe that honey in sections is manufactured, because it is unlike the honey they saw on the old farm. Except in a very small way it is impossible to make honeycomb as perfect and delicate as the bees do. On a commercial basis it is an utter impossibility. Dies *could* be made that would press wax in a semi-melted condition in the shape of a honeycomb. So far, so good; but it is utterly impossible to make any dies that will *free* themselves from the comb after it is pressed into shape, without tearing the comb to pieces. Talk with any mechanic or die-maker, and he will tell you the idea is utterly absurd. Even if we could construct the combs it would be impossible to fill them with glucose, and equally impossible to spread a film of wax over the filled cells that would come anywhere near imitating the appearance of comb produced by the bees. Any consumer who has a suspicion that combs in sections are manufactured has only to look over a dozen or more sections at any grocery. He will find no two of them alike. If combs were built from dies, they would appear all alike, like the common rough-faced cement blocks which are made in one mold. But a comparison of any two boxes of comb honey will show that bees make each section totally different from all others. The attachments at the sides of the sections vary as well as the surfaces of the cappings themselves.

It is hardly necessary to tell the reader of this work that combs are not manufactured; but sometimes he will meet prospective customers who will tell him in the most brazen way that the product he is trying to sell them is "manufactured." Therefore he should be reinforced with arguments and reasons to show them their mistake. Nay, he can go even further, and say that the authors of this work will pay ten thousand dollars if they will furnish any proof showing that such a thing as manufactured comb honey is or ever was on the market that even approximates the natural product made by bees.

APPLIANCES FOR PRODUCING COMB HONEY.

Years ago, all comb honey was produced in glass boxes. These were about five inch-



One piece section honey box.

es square, fifteen or sixteen inches long, glassed on both ends. They were not altogether an attractive package, and were never put upon the market without being more or less soiled with burr-combs and propolis. As they held from ten to fifteen pounds of honey each, they contained a

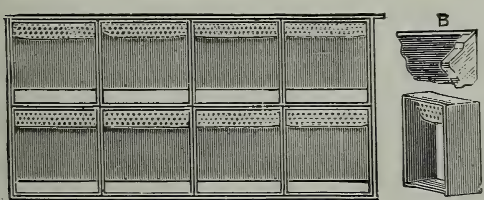
larger quantity than most families cared to purchase at once. To obviate these and other difficulties, what is popularly known as the "section honey-box" was invented.

It was what was wanted—a small package for comb honey. Thus was accomplished, not only the introduction of a smaller

package for comb honey, but one attractive and readily marketable. The retailer was at once able to supply his customer with a small quantity of comb honey without daubing, or fussing with plates. The housewife, in turn, had only to lay the package upon a plate, pass a common table knife around the comb, to separate the honey from the section proper, and the honey was ready for the table, without drip.

DEVICES FOR HOLDING SECTIONS WHILE BEING FILLED ON THE HIVE.

Sections can not very well be placed on the hive without some sort of arrangement to hold them. There are a score of different sorts of wide frames, racks,

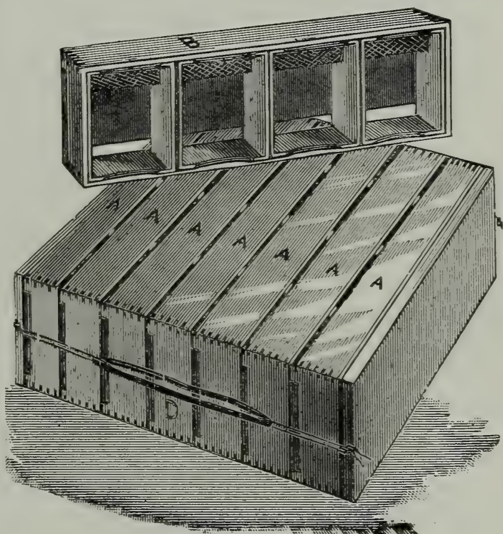


Double-tier wide frames.

trays, boxes, clamps, all of which possess some special features. It would be impracticable to show all of them; but for the sake of illustrating some principles it may be well to mention some of those that were used most largely.

What was known as the double-tier wide frame was perhaps the first device for holding sections in the hive. This consisted of a frame of the same depth and length as the ordinary brood-frame, but of the same width as the section, as shown in the illustration. This was used very largely at one time; but in the course of time it was discovered that it had several objectionable features. First, a whole hiveful of them gave the bees too much capacity to start on; and, as a consequence, this discouraged them from beginning work. Second, they did not permit tiering up to advantage.

The Doolittle surplus arrangement consists of a series of *single-tier* wide frames having no projections to the top-bars, although shallow wide frames have been made with such projections. Both the double



Doolittle's single-tier wide frames.

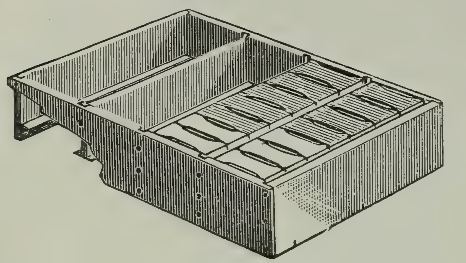
and single tier wide frames had the merit of protecting the surfaces of the sections from travel-stain and bee glue.

SEPARATORS.

Before we proceed further it may be well to say that all the devices for holding sections on the hives, with one exception, require what is called a separator or fence between the rows of sections. The separator may consist of a sheet of tin a little narrower than the depth of the section, or a thin piece of wood veneering.

Both of the devices already described make use of what is known as the old tin separator; but on account of the expense and the coldness to the bees, tin separators have almost entirely gone out, and in their

place have come the wood separators or fences. These latter will be described a little later on, in connection with the supers that take plain sections.



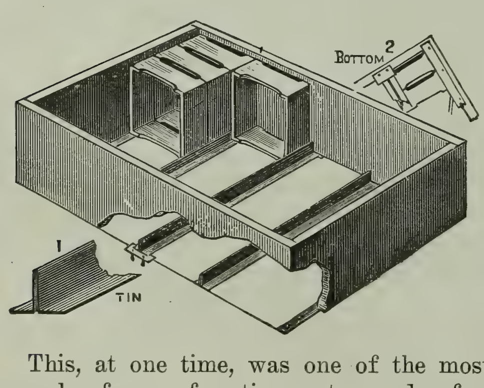
Moore (or Heddon) crate.

We will next describe a super that uses neither separators nor fences. We do not mention it here because we consider it a practical device, for indeed it has practically gone out of use altogether, for the simple reason that commission men and honey-merchants generally will not buy honey unless it has been produced with separators or fences. Or, if they take it at all, they will take it at greatly reduced prices.

This question, whether it is advisable to use separators or not, will be discussed further on. In the meantime, let us now consider separator supers.

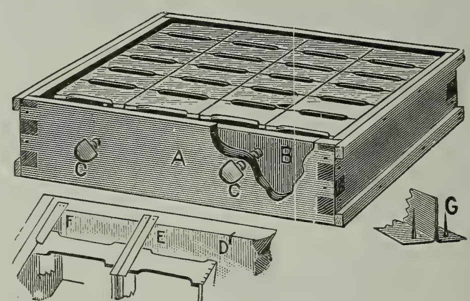
As the engraving shows, this is simply a shallow tray of the same depth as the section, plus a bee-space, and is divided off by transverse partitions—these very partitions preventing, of course, the use of separators; but those who did use this style of crate claimed they could get along without separators; that they had no difficulty in crating for market all their honey.

T SUPER.



This, at one time, was one of the most popular forms of section-crates, and a few prefer it to any thing else. It is so named for the T tins that support the sections. The tins are folded in the form of a letter T inverted, such construction making a very stiff and rigid support.

Some prefer, like Dr. Miller, to have the T tins rest loosely on a little piece of strap iron, or bent staple, both for convenience in filling the supers, and in emptying the same after the sections are filled. But there are others, like the late George E. Hilton, of Fremont, Mich., who objected to loose pieces, and preferring the super with stationary tins, the tins being nailed to the bottom inside edges of the super.



Hilton T super.

It will be noticed also that he preferred having compression—a feature which he accomplished by means of wooden thumbscrews and a follower.

SUPER SPRINGS.

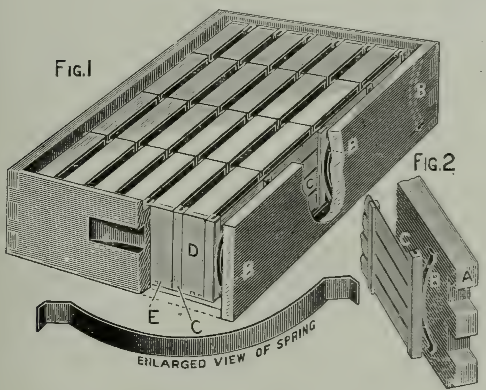
In the illustration of the Hilton super, it will be noted that thumbscrews are used to crowd a follower up against the sections. In the other form of T super a super spring between the side of the super and the follower performs the same office. Indeed, this spring is used nowadays in nearly all modern section-supers.

There is no denying the fact that in any form of surplus arrangement the sections and separators should be squeezed together to reduce accumulations of propolis. Formerly thumbscrews were used to some extent for this purpose, but oftener some sort of wooden wedge or tightening-strip. An objection to any thing of this kind is that if the sections in a super become swelled by any means the rigid strip of wood makes it very difficult to remove the sections. Sections, however, do not often swell in a super. But they do shrink quite often—indeed, quite generally. The joints of the sections have been moistened to prevent

breakage when the sections are folded, and then when the super is put on the hive there is a material shrinkage. That shrinkage makes more trouble than swelling, for the contents of the super become so loose that the wooden strips fall down, leaving the sections very loose in the super, and the bees improve the opportunity to crowd a lot of propolis into all the cracks.

To remedy all this trouble the steel super spring has come as a boon. Its pressure is constant. It adapts itself to any swelling that may occur, and equally adapts itself to any shrinking, so as to press the parts together at all times enough to prevent the bees from crowding in propolis.

In the illustration it will be seen at B, B, B, that a spring is crowded vertically between the side of the super and the middle post of the fence, and also between the side of the super and the two end posts of the



Super springs.

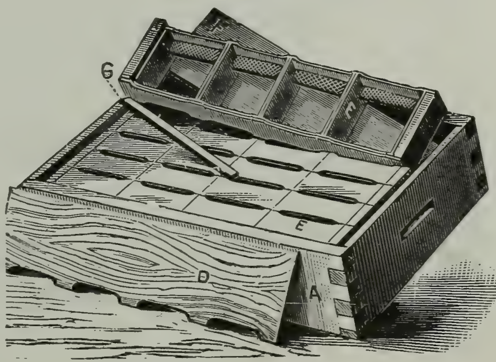
fence. When a follower is used, two springs (one at each end) are crowded vertically or diagonally between the side of the super and the follower. Some use only a single spring at the middle of the follower.

But the T super has its objections. If the sections are inclined to be a little out of square, or diamond-shaped, when folded, they will not be squared up in the T super unless an extra set of T tins or strips of wood are used to fill up the gaps between the rows on top. And, again, it is not practicable to alternate the several rows of sections. Sometimes, in a poor honey-flow, it is desirable to move the center row of sections to the outside, and the outside to the center. And still again, four-beeway sections, or plain sections, are not as advantageously used in these supers as in some other form we shall presently describe.

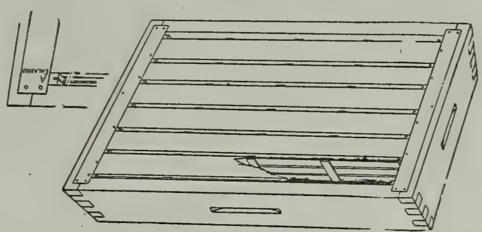
DOVETAILED SUPER WITH SECTION-HOLDERS FOR BEEWAY SECTIONS.

This is the form of super that has been, perhaps, used more largely than any other. It is a sort of compromise between the old-style wide frames and the T super. It consists of a series of section-holders that are open at the top. Each holder is supported at the end by a strip of tin nailed on the inner edge of the ends of the super, as shown in the accompanying illustration.

Four sections in each section-holder are held snugly and squarely in position with no spaces between the rows of sections as

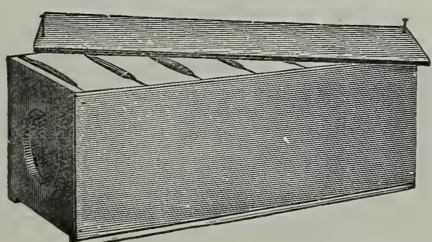


in the case of the T super. When beeway sections are used the bottom-bars of the sections are scored out to correspond with



the beeways. Between the rows of sections is dropped a wooden separator, as shown at D.

FARMERS' HONEY-BOX.

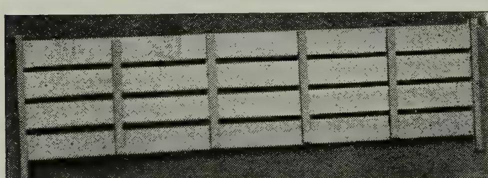


The case just shown is very popular with farmers. Four of them containing 24 sections without separators are placed on the

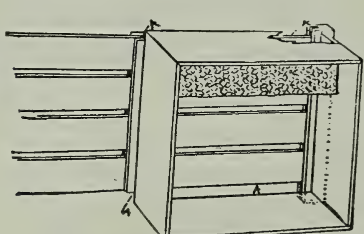
hive. When they are filled they are taken off without removing the sections from the case, and put on the market just as they left the hive. This is a sort of shiftless way, because some sections will not be entirely filled; but it suits the farmer who has no time to do the sorting, scraping, and getting ready for market; and in some local markets this case does very well.

THE FENCE AND PLAIN-SECTION SYSTEM.

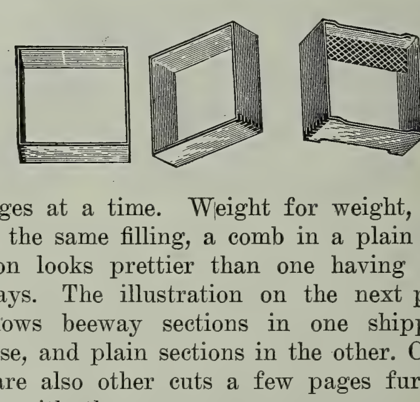
The sections and section-supers shown heretofore have been mostly of the beeway type. Brood-frames, when in hives, must be placed a bee-space apart; so also must the sections. Almost the first honey-boxes that were introduced had the bee-space cut



out of the top and bottom of the sections themselves, so that they could be placed directly in contact with each other or the separator. This kind of section continued almost up to 1897, when there was introduced a section without beeways, having plain straight edges all around. This had been used some ten or twelve years previously by various beekeepers who found it to be



in every way satisfactory. But plain sections (even width all around, without beeways) necessitate some scheme for holding them a bee-space apart while on the hive. Accordingly, a separator or fence was devised, having transverse cleats at regular intervals on both sides, binding the series of slats together—cleats so spaced as to come opposite the uprights in the sections. This will be shown more clearly in the annexed figure. It will be seen at once that the fence system provides for a narrower section, and yet this same section holds as much honey as one $\frac{3}{8}$ inch wider, because the extra width is taken up by the thickness of the cleats on the fences, as shown at A A A in previous cut or what would be in the old section two beeways of 3-16 inch each. In the cuts shown below there are specimens of beeway sections and no-beeway, the last being generally termed plain sections. It will be seen that they save quite a little wood, and consequently take somewhat less room in shipping cases. In other words, the twelve and twenty-four pound shipping cases can be made somewhat smaller, because it is not necessary to have each comb bee-spaced apart in the marketing-cases, the same as while on the hive. Moreover, the plain straight edges of plain sections offer special advantages in the matter of scraping. There are no insets, often roughly cut (as in beeway sections), to work into and around with a scraping-knife. A single sweep of the knife on each of the four edges will remove the propolis, or, better still, if the blade of the knife is long enough, one can scrape two



edges at a time. Weight for weight, and of the same filling, a comb in a plain section looks prettier than one having beeways. The illustration on the next page shows beeway sections in one shipping case, and plain sections in the other. Compare also other cuts a few pages further on with these.

But there is one more point to be taken into consideration. The fences are made up of a series of slats having a scant bee-space between each slat; and as the cross-cleats, or posts, are $\frac{1}{2}$ in. shorter than the length of the section, the beeway is very much wider. Instead of being a narrow opening through the top as in the old section, the opening is *clear across* the top, and part way down and up each of the sides. This gives the bees much freer communication, and, in consequence, has a tendency to reduce the size of the corner holes in each section. Then there is that factor, namely, horizontal openings between each

of the slats. This allows free communication from one section to another, not only *cross-wise* but *lengthwise* of the super. Both

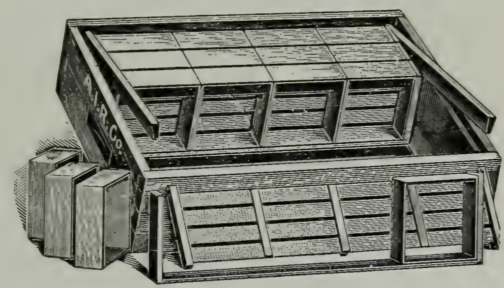
Shipping cases with beeway and plain sections.

theory and practice show that this results, under normal conditions, in a better filling of the boxes. A good many have already testified that they secured much better and more perfect filling of combs in plain sections than in the old style with solid separators; that the bees enter plain sections sooner, and that in some markets better prices are secured. There are others who say they can see no difference.

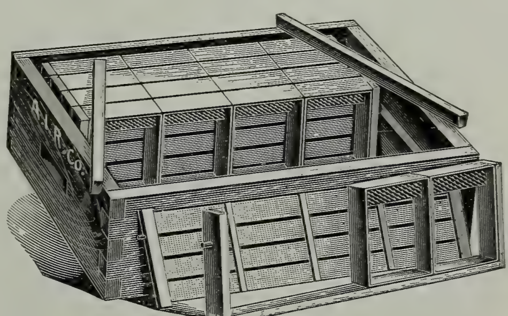
Under the same conditions the plain sections will be filled no better than the beeway. If there is any difference in the filling it is because the one offers special advantages in the way of freer communication; for in the ordinary old-style, with solid separators, each section, so to speak, is shut off in a little box by itself, and it has been proven that bees are disinclined to work in little compartments almost completely shut off from the rest. Open-corner sections, divided off by means of slatted separators, without cleats, ought to be and would be filled just as well as plain sections divided off by fences; for the conditions will be precisely the same, because the beeways, made part and parcel of these sections, exactly correspond to the beeways (cleats) on the fences. But one would lose many of the advantages of plain sections if he were to adopt the open-corner boxes. They would not look, with even filling, as pretty as plain sections.

In the main, these differ very little from the section-holder super already shown and described for the old-style sections. The

SUPERS FOR PLAIN SECTIONS.



section-holders themselves are the same width as the sections. Between each row of sections in a section-holder is placed a



fence, the end-post of the fence resting upon the strip of tin nailed on the bottom inside edge of the end of the super. There is

a fence on the outside of each outside row of sections, because it was demonstrated by S. T. Pettit that a perforated divider, or what is exactly the same thing in principle, the fence, when placed between the outside rows and the super sides will result in having those outside rows of sections filled, in many instances, as well as those in the center. The reason of this is, that it places a wall of bees on each side of the fence, between the comb honey and the super side; and these walls of bees, so to speak, help to conserve the heat so they can draw out the comb and complete the sections on the outside as well as in the center.

HOW TO PRODUCE COMB HONEY.

In order to produce comb honey the colonies must be very strong; that is to say, the hives must be fairly boiling over with bees. There is not much use in trying to produce section honey if the colonies are only two-thirds or half strength. It is also important that the great mass of our bees forming the big colonies should be old enough to go to the field. A colony may be numerically strong enough, but not have enough bees of the right age to go to the field when the harvest of honey is just beginning, or is at its height.

But suppose we do not have our colonies strong enough. What are we going to do? Three courses are open to us. One is to run these colonies for extracted honey; second, unite or double up (see UNITING elsewhere in this work), or practice stimulative feeding. But where one is located in a clover or basswood region, and the honey-flows do not last more than ten days or two or three weeks, and comes along about the last of June or first of July, it is not practicable to practice stimulative feeding early enough so that we shall have bees of the right age to go to the fields when the harvest comes on. Most comb-honey producers advise giving the colonies plenty of stores during the fall, and, naturally enough, it is very important that the colonies be well protected, so that they will come out with fairly good strength the following spring. If our hives are not well supplied with stores in the early part of the season, of course the only thing we can do is to feed, and feed liberally. See FEEDING.

In some localities bees are not able to gather natural pollen; and if there is no pollen in the hive they will not be able to do much brood-rearing, no matter how much they may be fed. Under head of POLLEN we discuss the necessity of pollen for brood-rearing, and artificial substitutes for pollen.

Sometimes the spreading of brood can be practiced to advantage (see SPREADING OF BROOD).

Again, after we have made all preparations so that our colonies are in fine condition for the production of fancy comb honey, our plans are all brought to naught by either a failure of the expected honey-flow or because our bees are determined to swarm. This inopportune swarming can sometimes be held in check by entrances on all four sides of the hive (see ENTRANCES) and almost surely by the "shake-out" or "brushing" plan spoken of under ARTIFICIAL SWARMING, to which the reader is referred. He should read very carefully the means for preventing or controlling swarming before he goes any further with this subject, or he may lose a large part of his crop.

WHEN AND HOW TO PUT ON SUPERS.

If the colony is in one story and the bees begin to come in from the field, and combs are whitened near the tops, frames fairly well filled with brood and with honey, we put on supers. If we have supers containing half-depth extracting-combs, we prefer to put these on first, even if we desire to produce comb honey, for the bees will enter them much more readily, and begin storing above. Then when they *are once well started* we raise the extracting-super up and place under it a comb-honey super containing sections filled with *full sheets* of foundation.

The usual practice is to put the comb-honey super on at the start; but in our experience, Italians especially are loath to enter the boxes. If they *once get into the habit* of going above, they will keep it up, even if the super is changed. The extracting super can remain on top of the same hive on which it was put in the first place, but we would put it on some other colony to give it the "upstair fever," after which it should be replaced by a comb-honey super. After a little there will be some filled extracting supers as well as those of comb. By proceeding on this plan we have found

that we can produce just about as much comb honey as we should if we put the comb-honey supers on in the first place, with the additional advantage that the extracted honey obtained is just so much clear gain.

Two of our correspondents sent to *Gleanings in Bee Culture* their method of using extracting combs to bait the bees above. One uses a whole super of shallow extracting-combs, and the other uses both sections and extracting-combs in the same super. We have thought best to give them both here. The first mentioned writes:

I have been, for several years, very much interested in trying and comparing different methods of handling bees for honey comb. I have been in the business for eight years, and have had fair success. For the first five years I tried a different method each year. Three years ago I tried an experiment that succeeded so well I have followed it up, and have in a measure overcome the two greatest difficulties that I had to contend with—loafing and swarming. We use the eight-frame Dovetailed hives with section-holders for $4\frac{1}{4}$x$4\frac{1}{4}$ sections. Our bees would always begin to loaf or hang out on the front of the hives when we put on the sections, and most of them would do but little in the sections until they had lost several days, and then would swarm, thus losing several days of the first alfalfa bloom.

I had sixty colonies of Italians in my out-apiary, and in trying my experiment I tried to be fair. I took 30 supers of half-depth extracting-frames full of comb from the home apiary, and put them on 30 hives in the out-apiary at the same time that I put sections on the other 30 hives. In four or five days the extracting-combs were full of new honey, and the bees excited and busy at their work, while most of those having sections were loafing, and some had swarmed.

I raised the combs by putting a super of sections between them and the brood-nest. At the end of two weeks from putting on the combs those sections under the combs were better filled than those on the hives that had no combs. As soon as the combs were sealed, I put them away to extract, having that amount of honey extra, and the bees started nicely in their work. I had only about a third as many swarms from those hives as from the ones with sections and no combs.

I liked the plan so well that last year I had enough of those little combs built to furnish a super of them to every colony that was to be run for section honey.

I tried the plan again this year, and from 75 colonies at the out-apiary I had 8000 fine white marketable sections, about 500 lbs. of unfinished and imperfect sections, 1500 lbs. of extracted honey, and 60 lbs. of beeswax, and two barrels of vinegar. We got short of fixtures, and I had to cut out some of my little combs, and have the bees build them again to keep them at work. I forgot to mention that we sell a lot of those combs to families for home use, as we can sell them cheaper than sections. When we cut them out we do so after extracting, and then the washings make good vinegar, and the wax goes into the solar extractor, and is of the best quality. We leave half an inch of comb at the top of the frame, to save putting in foundation. I do not believe we shall ever be able to overcome swarming entirely, but I believe my plan stops the loafing better than any thing else I know of. We had 57 swarms this year, but no loafing in the out-apiary. We have bought an extractor for that apiary, and will continue to run on that plan to start them to work. After the first super of sections is well started there is no more trouble about loafing. My neighbor's bees loafed and swarmed through all the best of the season, while mine worked hard.

MRS. A. J. BARBER.

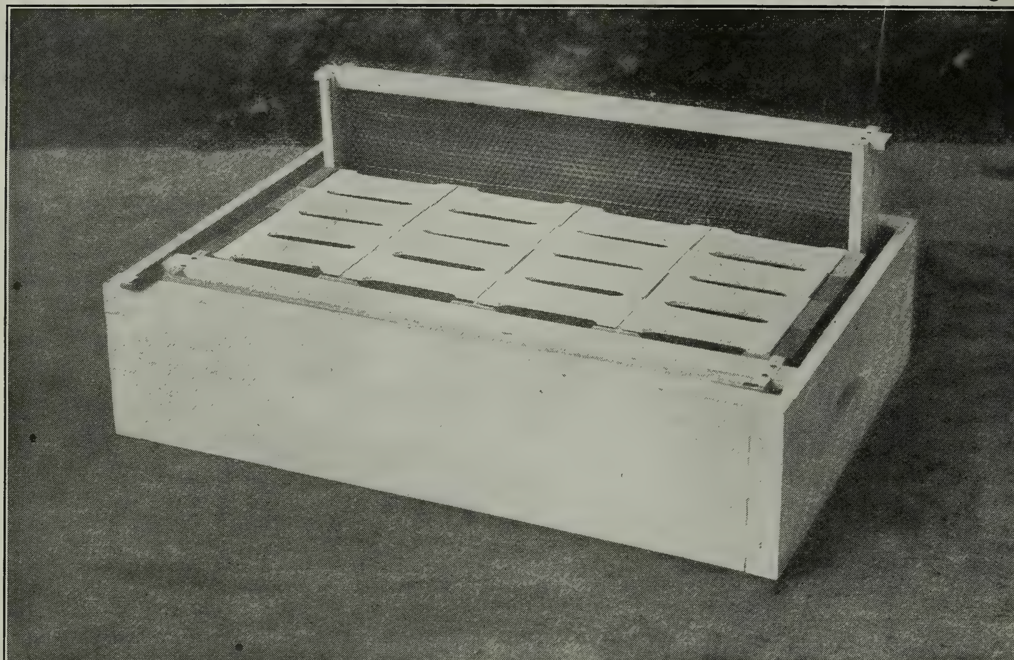
Mancos, Col., Nov. 17, 1898.

Other correspondents to *Gleanings in Bee Culture* have reported good results from following the same methods. It is particularly applicable where both comb and extracted are called for.

Mr. E. D. Townsend, Remus, Michigan, the other correspondent, goes one step further than the Barber plan by producing comb and extracted honey *in the same super.* Instead of putting on a case of extracting-combs, and afterward substituting therefor one containing sections, he has a special super which contains *both* extracting-combs and sections.

The illustration, next page, shows a comb-honey super containing 4x5 sections. This is equipped precisely the same as any other super for sections except that it has extracting-combs with closed-end frames on each outside. Where a super of this kind is placed on a hive the bees immediately occupy the drawn comb at the sides of the super and begin their storing. The comb being already drawn out, it is a very inviting place in which the bees can begin storing. Having made a nice start in the two side extracting-combs they work toward the center—that is to say, they begin to draw out the full sheets of foundation in 4x5 sections next to the combs, and store in them. When work is once in full progress in the side sections of the super, the center ones will take care of themselves with the result that every section is finished about the same time, and of about equal fullness. When the super is completed, the two extracting-combs will be filled and capped as well as the section honey-boxes. The former can be extracted and used over again.

It will be seen that the extracting-combs serve the purpose of excellent baits; and Mr. Townsend draws attention to the fact that, when such baits are placed at the *sides* instead of in the center, they cause an even filling of the entire super; whereas by the old plan of putting bait combs in the middle of the super the storing begins around the baits, gradually working from the center to the outside. This naturally brings about



T super containing two extracting-frames with wide end-bars, so that they take up the same amount of room as a section-holder.

a better filling of the center sections, leaving those toward the sides at a much later stage of comb-building and filling. The result of this is that the center sections will be filled in advance of the outside ones; and by the time these latter are filled, all the former will be travel-stained, and may induce swarming in the meantime.

When Mr. Townsend first began this scheme of comb and extracted honey production from the same super he had in mind only baiting the bees up into the sections; but he incidentally discovered that, inasmuch as the bees would enter such supers without hesitation, he thereby almost entirely overcame swarming.

Comb-honey producers all know that the ordinary section-super placed on a hive is very often not entered readily by the bees. The series of little compartments (the sections) cause the bees to sulk, and before they actually enter the super they may swarm in disgust.

It is well known, also, that after bees are once started going above, there is less inclination on their part to swarm. Mr. Townsend finds that the two side extracting-combs that he puts in every comb-super start the bees into the super about as readily as they would if containing extracting-combs only. The whole effect of this procedure is such that swarming is reduced to a minimum—almost brought under control.

For the local markets, the side extracting combs can be cut out and sold for chunk honey at about the same price as that in the sections; so that there need be practically no loss; or when there is a call for liquid honey it can be extracted.

One of Jay Smith's hives, showing extracting-combs at the side of the super, a la Townsend.

They work well started in the extracting combs at the side of the comb-honey super. Note that the row of sections just back of the extracting frame is well along, and that the second row back is started.

The Danzenbaker super, already described, with its 4x5 sections, section-holders, and Danzenbaker frames, is well suited to carry out the Townsend plan.

Even the shallower supers using 4¼x4¼ sections can be similarly arranged.

Mr. Jay Smith, of Vincennes, Ind., has been using the Townsend plan with good success. He writes:

I have been using Mr. Townsend's plan of putting extracting-combs at the outside of the sections, and feel that in this Mr. Townsend has given the bee fraternity a most valuable kink. In the engraving will be seen a super just set on the hive. The bees immediately take possession to clean it up. They will at once go to work and store honey in the comb. The other picture shows the work as it progresses. The outside extracting-frame is partly capped. The comb-honey section next to it has honey in it, while the third has work just commenced. After the bees begin in the center ones they will push the work there a little faster, with the result that the entire super is finished at once and can be set aside for market without sorting.

I am running eighty colonies on this plan this year, and I have never had a single case of loafing, and the bees work with all the energy they possess. When I read of some who let the hive-body get clogged with honey, and the bees cluster out, and they "shake" energy into them, I thought the beekeeper was the one who needed shaking instead of the bees. With the above system I usually have about six per cent of swarms. This was the worst year for swarms I ever had, and the per cent of swarms was ten.

BAIT SECTIONS.

Some beekeepers, however, while admitting the excellence of the plans given for those who want part of their crop in extracted honey, say that there is no need to use extracting-frames to start the bees at work in supers, since the same thing can be accomplished by means of what are called "bait sections," thus securing the entire crop in sections.

A *bait section* is one which has been partly filled with honey, which honey is afterward emptied out by the bees, generally in the fall. It is thus a section containing drawn comb, but having no honey in it, to all intents and purposes an extracting-comb on a small scale. Bait sections thus prepared are kept over winter, to be used at the beginning of the next honey-harvest.

If a single bait section is put in the middle of the first super that is given to a colony, it is claimed that the bees will begin work in it as promptly as they will begin work in an extracting-comb. Some use more than a single bait in a section, but there may be no great advantage in this, and the number of baits should be limited as much as possible, for when a section is thus filled the second time it is not so beautiful as one filled the first time. A bait section is not needed in any super after the first.

WHAT TO DO WHEN BEES REFUSE TO ENTER THE SECTIONS.

At times bees will show a disposition to loaf, and consequently a disinclination to go into the sections. They will hang out in great bunches around the entrance, while the surplus-apartment is left almost entirely vacant, to say nothing of foundation not being drawn out. This condition may be due to the backwardness of the season, or to a too small force of bees of the right age. During those years (which are not frequent) when the bees have not yet filled their brood-combs after the honey season is nearly over, and as the days progress, make little if any increase in the quantity of honey, we can not expect the bees to go above until all the available cell room below has been filled, as a rule. When this is crammed full, and there is a rush of nectar, they will commence work in the sections. We will suppose we have a fair average season, and some colonies are storing honey in the supers, and others are not. Suppose, also, that there is nothing in the supers to induce the bees to enter except the sections with starters, although the bees will begin more promptly if sections are filled with foundation. It is possible that a colony which does not enter the supers when other colonies have done so, refuses to enter because the hive is not properly shaded, and, as a consequence, the surplus apartment is overheated by the direct rays of the sun. In this event, if you can not extemporize some other kind of shade, use a shade-board, or an armful of long grass with a stick or two of firewood to keep the grass from being blown off the hive. (See APIARY.) Possibly the brood-chamber may not yet be filled, for so long as there is room there the bees will not trouble to seek room elsewhere. Possibly the trouble may be in the bees themselves, for some bees are slower than others about entering supers. In that case you must offer some inducement more than the starters of foundation to get the bees above. You can manage in some way to place above an extracting-comb a bait section, or even part or the whole of a brood-comb. Only if brood is put above it must be taken away as soon as the bees have begun work beside it. A nice thing to do is to go to another colony which is working in supers, and take from it a section which the bees have filled perhaps half full, and give it to the tardy colony. If the bees adhering to the section are taken too, it will be all the better. Perhaps a little better still it will be to take a whole super, bees and all, from a colony which occupies two or more supers. After you have offered either of these special inducements, you may know that if work does not go on in the super it is because the colony is too weak. It requires *strong* colonies under *any conditions* to do much work in the supers. The hive should be boiling over with bees.

But it is very much better to give the proper inducements *in advance* to all colonies. If you want part extracted honey, you can hardly do better than to adopt the Townsend plan. If you do not want the extracted honey, put a bait section in the first super given to each colony. Having offered thus much in the way of inducements, if work does not go on in the sections, you may be pretty sure that either the colony is not strong enough, or that enough honey is not coming in from the fields.

TIERING UP.

If honey is coming in at a good rate, you may expect (if the bees have started above) that the super, or case of sections, will soon be filled about half full of honey—with the sections in different stages of completion. When the super is about half filled with honey, raise it up and place another empty super under it. About the time this reaches the condition of about half completion, raise both supers and put under another empty one. This process of "tiering up," or "storifying," as it is called by the English, may be continued until three, four, or more high, depending upon the length of the honey-flow and the amount of nectar coming daily. In the mean time the ripening process of the honey in the first super continues. In most localities it is not practicable to tier up more than two supers high.

CAUTION.

Care must be exercised in tiering up, or a lot of unfinished sections will be the result. When the honey-flow is drawing to a close, and you discover that there is an evident decrease in the amount of nectar coming in, give no more empty supers. Make the bees complete what they have on hand, which they will do if you are fortunate enough in your calculations as to when the

flow of nectar will end. If uncertain whether another super is needed or not toward the close of the harvest, it is often advisable to put another super *on top*. The bees are not likely to commence on this till they really need it. It is impossible to give general rules on tiering up; but with the assistance of the foregoing you are to exercise your own discretion.

WHEN AND HOW TO TAKE OFF SECTIONS.

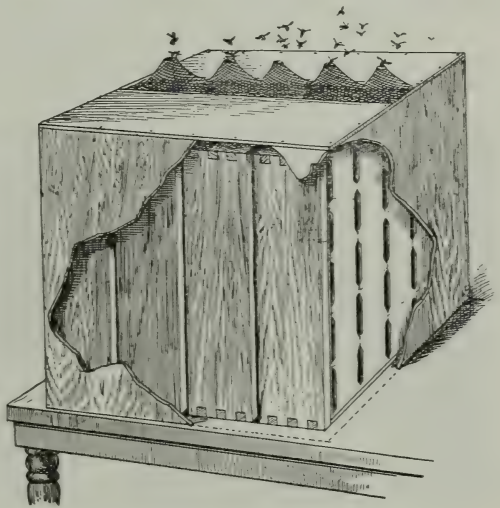
Usually it is not practicable to wait till every section in a super is completed; that is, until every cell is capped over. Those sections most liable to be unfinished will be in the two outside rows, and these the bees will be long in completing. If the honey-flow is over we would not wait for them to be completed, but would take the whole super off at once. The longer it remains on the hive, the more travel-stained the honey will become, and the more it will be soiled with propolis. However, if you desire a really fine, delicious article of comb honey, one more pleasing to the tongue than to the eye, and are not particular about the white marketable appearance of the cappings, leave the super on the hive for two or three months. Most beekeepers agree that comb honey left on the hive acquires a certain richness of flavor not found in honey just capped over. Although such honey is really better, it is not quite so marketable because the cappings in the mean time become more or less travel-stained.

If one is producing very much comb honey he can scarcely afford to get along without a scale hive. See SCALE HIVE, found in alphabetical order.

HOW TO GET BEES OUT OF THE SECTIONS WITHOUT BEE ESCAPES.

There is one danger in leaving honey on till after the honey-flow. As soon as you open the hive, the bees, especially hybrids, are apt to uncap and carry some of the honey down. Whether you leave it on the hive or whether you remove it as soon as capped, the methods of taking off and getting the bees out will be much the same. In the latter case, some supers may not be filled with honey, although a glance at the top may show nice white capped combs. Satisfy yourself by lifting one up and looking under. If capped below, it may be removed. To take off, blow smoke into the top of the super for a little while, to drive most of the bees down; lift off the super, and set it on end near the entrance or on top of the hive (not as it sits on the hive, or you will kill bees). If honey is coming in freely, robbers will not molest, and in two or three hours the bees will have left the super and gone into the hive.

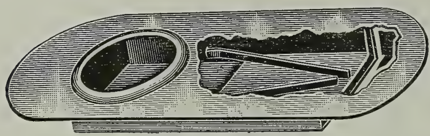
Until you have had some experience, perhaps your safest plan is, never to set a super of honey by the hive. Sometimes it may be safe to let it stand there all day when the bees have more than they can do on the flowers; but, again, all at once it may start the bees to robbing, and demoralize them generally.



The Whitney bee-escape case for clearing the bees from comb-honey supers.

If the honey-flow has stopped or is tapering off, to avoid the possibility of robbing it would, perhaps, be better, after smoking the bees out as far as possible, to give the super a vigorous shaking in front of the hive; then with the bee-brush clean off the bottom and top of the super; this will clean out nearly all the bees. The super should then be placed inside of a building. What few remain will desert, fly to the window-screens, and get out through the bee escape, which should be provided in all well-regulated honey houses. But a better plan, perhaps, would be to shake out most of the bees as before described, then stand the supers on end, and set over a case with bee escapes on top, like that shown in the subjoined engraving. This is used by W. M. Whitney, of Lake Geneva, Wis.

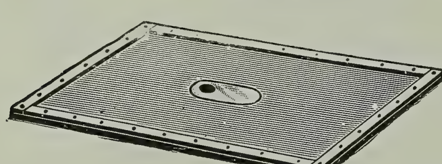
By far the most satisfactory arrangement for getting bees out of supers is the regular Porter bee escape. This is mounted on a board, cleated at the ends and sides,



Porter bee-escape.

in such a way as to provide a bee-space on one side, so that it can be placed between the supers and the brood-nest beneath. But care should be taken that it be placed right side up—that is, the side up as shown in the illustration. If the device be put on toward night, or, better, along in the afternoon, by the next morning practically all the bees will be out of the super and in the brood-nest below; or in some cases will have gone from the finished super into one partly finished.

Our method of putting on one of these escape-boards is as follows: With a hive-tool, screw-driver, putty-knife, or pry, loosen the super so that propolis connections will be severed or broken. Now with one hand tilt up the super at one end enough to make a gap, and with the other hand take the smoker and blow in two or three whiffs of smoke to drive the bees back.



Next lift the same end of the super up a little further so that it will stand say at an angle of nearly 45 degrees. With the free hand set down the smoker and pick up the escape-board, which should be leaning conveniently against your person. Slide this on top of the hive as far as it will go, bee-space side up. Let the super down on the escape-board gently, and, last of all, bring the escape-board and super so they will align with the hive.

You will find this method eliminates hard lifting, saves time, prevents angering the bees, and avoids killing them.

The best time to put on Porter escapes is at night. If thirty or forty of them are put on, the next morning about nine o'clock there will be about thirty or forty supers ready to come off, with but few bees in them. If there are three or four bees left, or say a dozen, they will usually take wing as soon as the super is uncovered.

Method of inserting the escape-board.

SCRAPING SECTIONS.

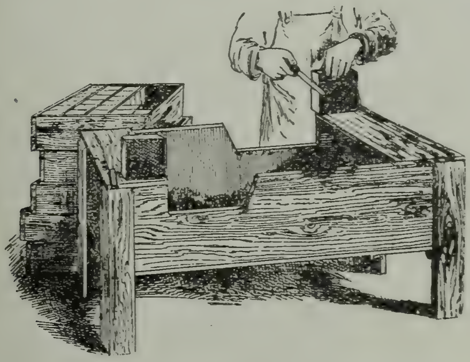
In order to make sections present a clean marketable appearance, all propolis should be scraped off. Some prefer, for this purpose, a case-knife; others, an ordinary sharp jack-knife. But whatever implement is used, scrape the sections nice and clean. Be careful not to gash into the honey. Before you commence the operation you had better put on some old clothes, because the particles of propolis will be almost sure to ruin good ones.

BOOMHOWER SECTION-SCRAPING TABLE.

Mr. Frank Boomhower, of Gallupville, N. Y., has a section-scraping table like the one shown herewith. As will be seen, two scrapers can work at a time, the sides of

the box or tray being cut away in such a way as to allow a knife to scrape down clear past the edge of the section. Each section, as it is scraped, is put into the shipping case. We have seen this table in operation and know that it is just the thing for hand scraping.

Those with only a few sections will not be likely to have such a table, and some large producers might not prefer to use it. Any ordinary table may be used for the work, or a board on the lap will answer. It is easier to do the work sitting. A block 2 inches thick, more or less, and 4 inches square, the size not being important, lies



Section-scraping table.

on the table, or on the board on the lap. When the section is placed upon this block, projecting over one side, it allows free play for the knife. If the super is of such character that the sections may be taken out *en masse,* the work may be greatly shortened by cleaning all the tops at one operation, and the bottoms in the same way. Indeed, no matter what the super, one may shorten in this way: Make a rim, or box without top or bottom, whose depth is an inch or so less than the height of the sections to be cleaned, and an inch or so wider and longer than the superful of sections. Have two boards as large as or a little larger than the rim mentioned. Lay a board on the table, set the rim on the board, and then fill the rim with sections. Put into one end a thin board as a follower and wedge it up. Do the same at one side. Now, with a cabinet-maker's scraper or some other tool scrape the propolis off the entire surface. Follow this up with No. 2 sandpaper. Now lay the other board on top of the sections. Turn the whole thing upside down. Take the top board off the sections. Loosen the wedges as much as necessary to let the rim drop down on the board and then wedge tight again. Scrape and sandpaper as before. The sections may now be taken out and finished on the little block as before mentioned. It is a convenience to have a large table and a number of boards. Each board may be slid along on the table out of the way, or it may be piled up on another boardful of sections.

Both scraping and sandpapering will work better when it is so cool that the glue is brittle. Indeed, sandpaper will not work on soft glue.

UNFINISHED SECTIONS.

The more carefully the apiary is manipulated in the matter of working for comb honey, the fewer will be the number of unfinished sections; but all such are not always the result of improper working of the colonies. With the best of care a sudden stoppage of the honey-flow will throw on the beekeeper a lot of these sections; for such stoppages of the nectar supply, no one can foresee in some localities. In the alfalfa regions, and in some other places, it can be told within a few days when the honey will stop; it is then possible so to arrange the supply of sections on the hives as to leave very few of them unfinished when the season does finally close.

HOW DR. MILLER PREVENTS AN OVERSUPPLY OF UNFINISHED SECTIONS.

Dr. Miller takes off his supers as soon as a majority of the sections in the super are finished. The latter are set aside to be scraped and cased for market, while those unfinished are set back into the supers—the supers to go back on the hives immediately, consequently *before the honey-flow stops.* By proceeding thus, he manages to have few unfinished sections at the end of the season. Those that are returned to the hive he fittingly styles "go-backs." These, as fast as they accumulate in the honey-room, are put into the regular hive-supers. Part of these go-back supers may be placed on colonies that show a special aptitude* for finishing up work already begun in sections, and a part may be placed on the regular colonies already at work on their own sections. The great advantage of this plan is that it allows the sections to be taken off be-

* Some colonies are better at finishing up work already begun than at starting it from the raw foundation.

fore all in the super are finished, consequently before any of the central ones have lost their virgin whiteness.

Such a plan of procedure is possible only in localities where the honey-flow lasts sufficiently long, not only to fill two-thirds of the sections full in the supers, but enough longer to finish out supers of go-backs placed on hives afterward. Bees can be made to finish partly filled sections even when the natural honey-flow has ceased altogether by feeding back a thinned honey. See Feeding Back.

In any case, some unfinished sections will be on hand at the close of the season; for if the surplus be all stored in sections it is not possible to give the exact number of sections that will be finished.

WHAT TO DO WITH UNFINISHED SECTIONS.

Some prefer to dispose of unfinished sections by selling them around home for less money, or using them exclusively for home consumption. The honey, for eating purposes, is practically just as good; and it is the practice, in many beekeepers' families, to consume all such sections if they can, reserving those that are marketable and well finished to be sold.

Some beekeepers consider them very valuable for baits; that is, they place one of these in the center of a super to bait the bees above, as has already been explained. Others place them in stacked-up supers a few rods from the apiary. A very small entrance at the bottom of the pile, large enough for one or two bees to pass at a time, is provided. By this slow method of robbing, the bees will empty out the honey and carry it to the hives much more cheaply than the beekeeper himself can afford to do it by means of the extractor. While this slow robbing may cause a little disturbance in the yard at the time, it does no particular harm. But mark this: Never give the bees a wide entrance at the bottom. It should be only wide enough to allow one or two bees to pass at a time. This is known as the Miller plan, having been, we believe, originated by Dr. C. C. Miller. Taking every thing into consideration it is the safer one to follow; but where one is an expert beekeeper, and has a large lot of unfinished sections for the bees to empty out, a plan originated by the late B. Taylor is perhaps better. Dr. Miller, who uses the plan, thus speaks of it:

For a number of years I have used the Taylor plan at the close of every season. All sections that are less than half-filled are put in supers in the shop cellar, and the doors kept closed till the whole business is over, and *all* that are to be emptied are in the cellar. The supers stand on end so as to be all open, or piled in piles crossing each other. When no more are to be taken into the cellar I open the door, and say to the bees, "Go in." They go in, I assure you. The air is black with bees at the door, and they do more or less sailing about in the vicinity. Sometimes they do a little tearing of the sections, but not much. There is too large a surface for them to cover. Gradually they give up the job as the supply ceases, but the supers are not taken away till a week or two after the bees have stopped working on them. They might as well be put in the open air, only they are safe from rain in the cellar. Please remember that this is what I do at the end of every harvest after the flow has stopped.

As a matter of fact, I use the Taylor oftener than the Miller plan. It depends on the number of sections to be emptied in proportion to the number of bees. Whether little or much is to be emptied, I am not afraid of a rampage. I will set a super of sections on top of a hive and let the bees rob it out, and there will be no rampage. But I will be exceedingly careful not to take away the super until all honey is cleaned out, *and until at least* 24 *hours after the bees have stopped trying* to find any more honey there. Take away the super while the bees are at work at it. and wholesale destruction would follow.

Since foul brood has become so generally distributed over the United States, there would be great danger of spreading it among the bees if we practice the plan above described. Certainly it would not be advisable, in case any of our neighbors had disease among their bees; nor could it be recommended if foul brood ever had been among the bees within the last year or so. There would be danger that some colonies had the germs of the disease; and although they showed no evidence of it during the preceding season they might spread disease throughout the entire apiary. For this reason we would advise our A B C scholars at least to use almost any other plan than letting the bees rob out the supers.

GRANULATED COMB HONEY; WHAT TO DO WITH IT.

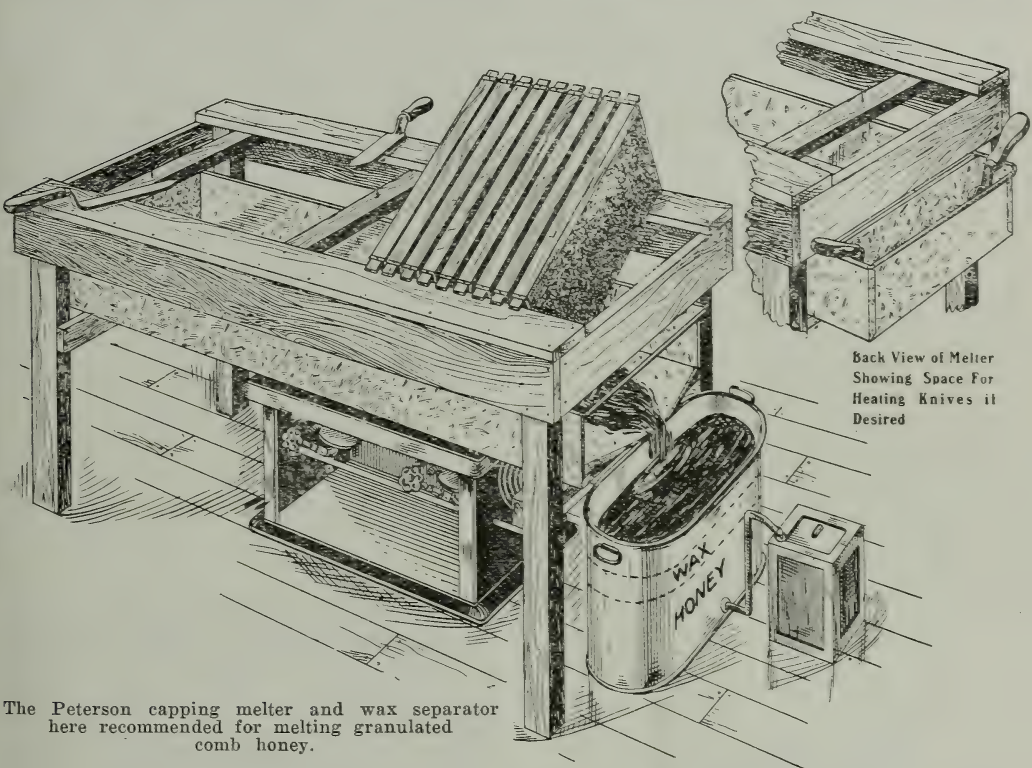
If your customers are not suspicious regarding comb honey, and have not had their heads filled with stories of artificial comb honey, etc., you can probably sell them granulated comb honey at very near the same price as that which is still in the liquid form; for candied honey in the comb is fine for table use. Some explanation should be made, however, to the effect that the honey going "back to sugar" does not indicate at all that the bees were fed sugar

syrup, and that nearly all kinds of pure honey will granulate in time.

If it is impossible to sell granulated comb honey at a pretty fair price, it may be melted up in a capping-melter, and the liquid honey and wax saved and sold separately. If there is any great amount of honey to melt up in this way a large capping-melter should be used, for it is important to have a good-sized heating surface so that the melted honey and wax may be separated as soon as possible. If a small melter is used and overloaded, much of the honey is likely to be confined in close contact with the heated surface for some time; and this, in connection with the wax, imparts to it a flavor that, while not disagreeable, distinguishes it from honey not so treated. On this account the outlet of the melter must not be allowed to dam up so as to confine the honey.

A framework should be made to fit the top of the melter, on which a wide board may be secured directly over the melter.

Use a sharp butcher-knife or steam uncapping-knife to cut the comb out of the section, then strike the notched or dovetailed corner of the section, causing it to fly open allowing three sides of the section to lie flat on the board. Beginning at the right-hand end, move the edge of the knife with a scraping motion toward the left, holding the section in the left hand by the fourth side, which should be at right angles to the other three sides lying flat on the board. Then use the other edge of the knife; and, beginning at the top of the fourth side, cut down to the board, thus removing quickly all the wax adhering to the wood. With a little practice the honey may be cut out of the sections very rapidly —perhaps faster than the melter can handle it; but in the intervals the heaps of scraped sections may be removed, new cases of honey set on the bench ready, etc.



Back View of Melter Showing Space For Heating Knives if Desired

The Peterson capping melter and wax separator here recommended for melting granulated comb honey.

The melted honey and wax as it comes from the melter should pass directly into a separator made on the principle of the Aikin separator. The large cut shows the whole melter, separator, etc. At the end of the day, or when the work is finished, the honey should be drawn off as close as possible to the wax, so that the smallest amount will be left to cool with it. The reason for this is that any honey is given a slightly waxy flavor if allowed to cool under wax. As soon as the honey is drawn off, and while it is still warm, it should be

strained through a cheese-cloth, so that it will be ready for market.

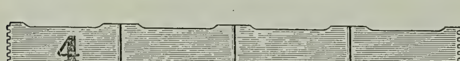
SHALL WE USE SEPARATORS?

Ten or fifteen years ago a good many comb-honey producers thought they could dispense with separators. Some few claimed they could produce just as good comb honey, as evenly filled and perfect in every way as that produced with separators. But after having looked over a good many carloads of comb honey it is our candid opinion that most if not all of the unseparatored comb honey is not fit to go to market. While it may look very neat and pretty, the difficulty lies right here: Some combs will be over full—that is, too fat, and others will be too thin. The trouble comes in crating such uneven combs in an ordinary shipping case. While such honey can be crated if one takes a good deal of time, the time employed in sorting over the sections and putting the lean combs next to the fat ones will cost much more than the extra expense of separators.

Many of our commission houses and honey-buyers to-day positively refuse to take unseparatored comb honey at any price. A few will take it at greatly reduced prices. The average honey-producer who *thinks* he can dispense with separators will probably have to make up his mind to sell for less money or peddle it out among his neighbors.

WHAT SIZE OF SECTION TO USE.

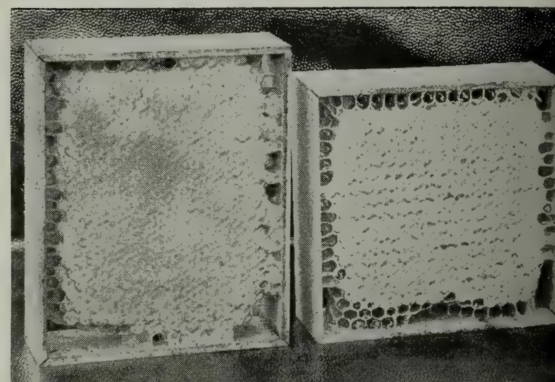
A few years ago there were a good many varieties and sizes and styles of sections on the market. For instance, there were the two-pound prize sections, the half-pound sections, and three-quarter-pound sections; but at the present time every thing has been eliminated down to practically three styles. First, the $4\frac{1}{4}$x$4\frac{1}{4}$x$1\frac{7}{8}$ beeway sections, the plain $4\frac{1}{4}$x$4\frac{1}{4}$x$1\frac{1}{2}$; and lastly the 4x5x $1\frac{3}{8}$ plain sections. All of these three hold a scant pound of honey. While it might be desirable to have something holding an



even pound, yet no two sections will run exactly the same weight. In some markets the sections are sold by the piece; but in most cases they are sold by weight.

TALL VS. SQUARE SECTIONS.

The standard section for a good many years has been and is $4\frac{1}{4}$ in. square; but, notwithstanding, during all this time, a good many beekeepers, principally in New York, have been using a section taller than broad. The late Capt. J. E. Hetherington, who had the reputation of being the most extensive apiarist in the world, used a section $3\frac{7}{8}$x 5.

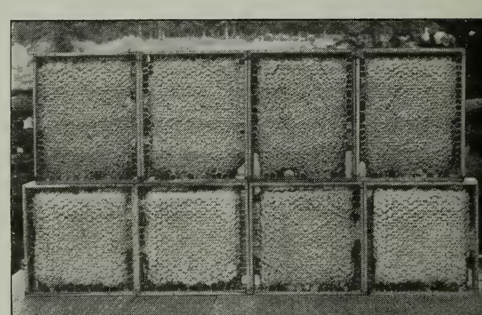


Comparative size of tall and square sections of the same weight.

Other beekeepers in New York use them slightly larger or slightly smaller, but of the same proportion. (See HIVES.)

Some of the reasons that have been urged in favor of the tall sections are as follows:

1. Weight for weight, and for the same thickness of comb, a tall section presents a bigger appearance than the average square one. In the 4x5x$1\frac{3}{8}$ tall plain section, for

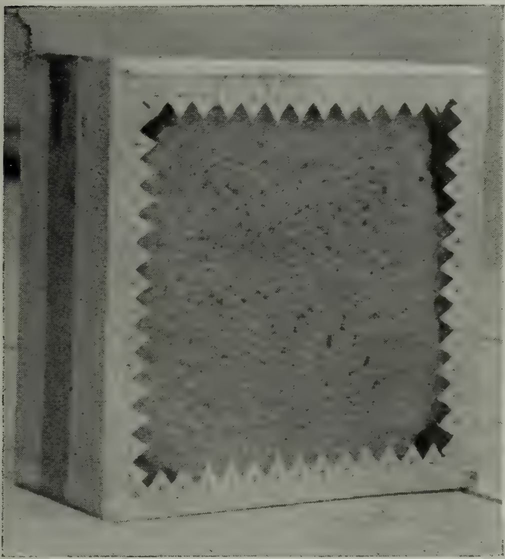


Same weight of honey in square and tall sections.

example, we have about the same actual weight as the $4\frac{1}{4}$x$4\frac{1}{4}$x$1\frac{1}{2}$ plain; and yet, as will be seen by the engravings, the former looks to be the larger. As a result the tall box brings in some markets anywhere from one to two cents more per pound, but in other markets it brings no more. If this were the only reason why the tall box is preferred, we would say nothing about it

here; but there are other reasons for this preference.

2. By long association we have come to like the proportion of objects all about us that are taller than broad. Doors and windows of their present oblong shape are much more pleasing than they would be if



An English glassed section.

they were square. Nearly all packages of merchandise, such as drugs and groceries, are oblong in shape—that is, taller than broad. To cater further to this taste, brought about by long association with the common objects around us, the tall section was introduced; and outside of its relative appearance of bigness as compared with the square box, very many consider the tall one much more pleasing.

3. Mr. R. C. Aikin, one of the closest observers in all beedom, lays it down as a rule that *"in comb-building the downward progress exceeds the sidewise in the proportion of about three to two* . . . If, then, comb construction goes on in this way, a section as wide as deep will be finished down the center before it is at the outer edges." A tall section, then, more nearly conforms to the natural instincts of the bees.

4. A greater number of tall sections holding approximately a pound can be accommodated on a given hive surface.

5. A tall section will stand shipping better, because the perpendicular edges of contact of the comb itself are greater than in a square box. This is not theory, but shipments of comb honey by the carload prove this.

GLASSED SECTIONS.

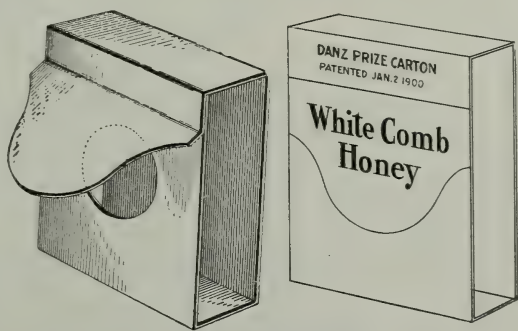
Glassed sections are simply sections of comb honey with squares of glass fitted in between the projecting sides of the section. The glass is held either by glue, tin points, or paper pasted over the top and bottom of the section, and lapping over on to the glass a little way. When the section is sold to the retailer, the glass is included in the price of the honey. Of course, the producer can afford to sell glass at from 12 to 15 cts. per lb.; but customers have sometimes objected, and justly, too. In spite of all this, glassed sections have quite a rage at times in New York and other eastern markets, and occasionally there is some sale for them in the West. In England such a section with a fancy border is sold quite extensively.

PASTEBOARD CARTONS FOR ONE-POUND SECTIONS OF COMB HONEY.

Mr. J. E. Crane, of Middlebury, Vt., formerly put nearly all his honey into cartons. These were put into unglassed shipping cases, the latter neatly stenciled with an old-fashioned straw hive, and lettered.

THE DANZENBAKER SECTION-CARTON.

This is somewhat cheaper than the others, and answers the purpose very nicely. It is shipped folded, and all one has to do is to



The Danzenbaker carton.

crowd on two opposite corners, when the package assumes a rectangular form as shown. This carton is specially adapted to use with a plain section, as will be seen from the illustration.

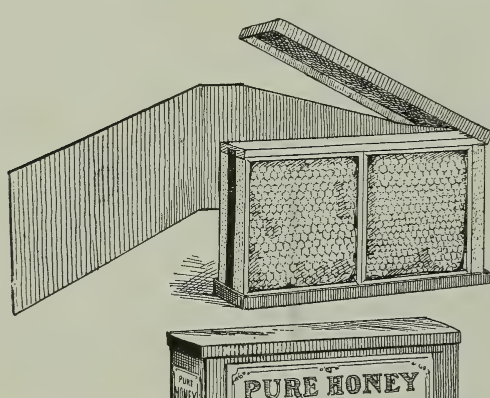
A new carton has been recently introduced to the trade that has a fancy engraved

design on the front panel, and the whole is printed in two colors. The spaces on the top and two sides and bottom contain appropriate printed matter. On the back there is a recital of the contents of the package, and a denial of the oft-repeated canard that comb honey is manufactured. On the two

sides is an explanation concerning honey and its flavors, and honey as a food. On the top is a statement showing that the contents are pure under the national pure-food and drug act of June 30, 1906; and all over the package the caution is given not to store the honey in a refrigerator or cellar, but to put it in the warmest and dryest place available.

THE FRANKLIN CARTON.

Mr. Benjamin Franklin, of Franklinton, N. Y., uses a two-section carton, for he says



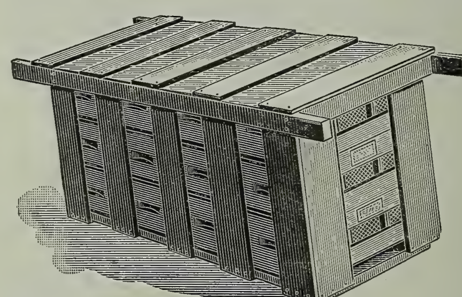
he can sell two sections as easily as one. The illustration here given shows how it is put together.

MARKETING COMB HONEY.

There is nothing that can make a beekeeper feel better than clean cash for his surplus honey at the end of the season.—*Adam Grimm, page 86, Vol. I.,* —GLEANINGS IN BEE CULTURE.

Every thing, nowadays, depends on having goods neat, clean, and in attractive shape, to have them "go off" readily; even our hoes have to be gilt-edged, for we noticed some once at a certain hardware store, and it seemed that those that were gilt, or bronzed, perhaps, were selling in advance of the plain ones. We've been told of gilt-edged butter that sold for fabulous prices, but we hardly think it will be advisable to put our honey up in that way, although we do wish it to look as well as any of the other products of the farm.

In order to get a fair price for your honey, you should watch the markets. To obtain this information, you should take one or more bee-journals. Through the medium of these you will learn whether the honey crop is going to be small or large. This you can not tell definitely from your own local-



Comb-honey carrier.

ity. If you have secured a grood crop of honey, and you learn that the crop throughout the country is small, you must not be in haste to dispose of yours to the first buyer. In any case you must exercise judgment.

HOW TO MAKE HONEY SELL IN THE LOCAL MARKETS.

Supply your grocer with a lot of your choicest extracted, in tumblers and bottles; and also best comb in shipping cases. Some of it should be set off in paper cartons, and some of it should be glassed. When customers come in, have in readiness strips of paper about $1\frac{1}{2}$ by 2 or 3 inches. Dip one of these pieces of paper, curled in the shape of a trough, into the extracted. Twirl it around till all the drip is off, and pass it quickly to your customer, that he may sam-

ple. If he would like another taste, hand him another slip of paper, which he is to fold as nearly as possible in the form of a spoon. If the honey is ripe—that is, good and thick—your taster will want some. There is one thing that is very important. You want something to draw a crowd. Prepare a nucleus in a glass hive, and put it up near the window where the crowd can see the bees. Sometimes the crowd will be so great as to block the street to see the queen or "king-bee;" but you will be the gainer, because *your* honey is inside.

There should be on hand for a day or two an expert to explain about the honey, how it is produced, how good it is, etc., and to show that it is the most wholesome sweet in the world for children. He should then reinforce his arguments by handing out honey-leaflets that contain cooking-recipes, and that tell why the doctors recommend honey in preference to cane sugars, or why some invalids can eat honey when they can not eat other forms of sweet. Perhaps you yourself will be the best man to do the "talking;" and therefore you had better stay with your grocer a day or two, or at least be on hand when he is likely to have a run of customers. Charge the grocer nothing for your services, telling him that you will take your pay out of the increased sales.

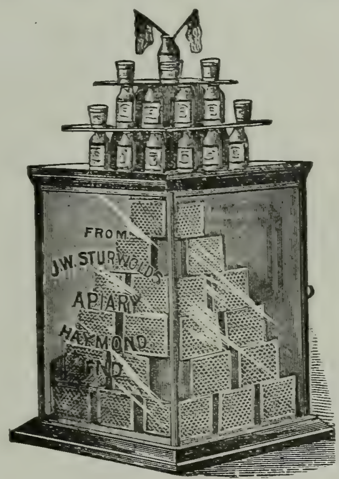
If you succeed well in one market, and the novelty of the thing wears off, try another one in a neighboring town, and so on complete the circuit of the towns round about. After you have done all this you will not need to ship much if any to the city markets, save commissions, save freight, and have your honey within a few miles of where you can look after it, without being at the mercy of a city commission house. See SHIPPING CASES; HONEY-PEDDLING; also EXHIBITS OF HONEY, subhead SELLING HONEY AT COUNTY FAIRS.

SENDING HONEY TO COMMISSION HOUSES.

We believe commission houses throughout our cities are great aids to beekeepers in disposing of their honey; notwithstanding, we want to enter a word of caution right here against being in too great haste to lump off your honey to these places. You may argue that you have not time to dispose of your product in small amounts; but many a beekeeper has found to his sorrow the mistake he made in contributing to the flood of honey at a certain commission house. The consequence is, that at that place honey is a "glut on the market," and must be sold at a very low price. As a general rule, we believe we would sell elsewhere before shipping it off to the city.

But it very often happens that one can get a higher price by sending to these commission men. The general trade looks to them for supply, and they make it their business to find a market.

Never send your honey on commission or outright sale to a new firm, no matter what it advertises, how big it talks of its financial standing, nor what promises it makes. Go to the nearest bank and find out regarding its responsibility. Then ask the commission house to send you the names of beekeepers who have dealt with it. But we would not



Sturwold's show-case for honey.

advise you even then to consider this an evidence of good faith. We would take time to write to the parties and ask if their dealings were *entirely* satisfactory, and whether they would advise shipping to the commission house in question. The temptations in the commission business are very great; and if your man is not honest to the core he may take advantage of you. Commission men charge all the way from 5 to 10 per cent commission; and in addition to this the shipper is required to pay freight, drayage, and to stand all breakage.

Most commission houses will make advances in cash on receiving the honey; and a few of them will make payments as fast as it is sold; but a majority make no remittance until the honey is all sold, and some-

times not even then until the beekeeper writes complaining, and inquiring regarding his honey or his money.

We have said that commission men should be strictly honest; but some of them yield to the temptation of quoting a higher price in the bee-journals than they are actually realizing in every-day sales. The beekeeper complains when he receives his returns, and he is met with the statement that his honey was of poor quality, and had to be sold for less money; or that the honey came badly broken, and had to be lumped off as chunk honey; or he may be told that the "market suddenly fell" (which may be true), and it was not therefore possible for the house to realize quotations given in the bee-journals. It is a common trick on the part of dishonest commission men to quote high prices if they can get their names in the bee-journals, then sell for lower prices in order to "move off stock." But we've had reason to believe that sometimes, from complaints that have come in, and from certain evidence placed in our hands, honey has actually sold at several cents higher per pound than was shown by the account of sales rendered to a beekeeper, and on which commission was based. In this way commission men practically take two commissions. Say, for instance, the honey sold for 12 cents. He makes returns to the beekeeper of 10 cents, and then charges 10 per cent commission on this 10 cents. He thus makes the 2 cents which he actually steals, and then the 10 per cent which is rightfully his.

In the foregoing we've endeavored to set forth some of the tricks that are practiced by some of the unscrupulous commission houses. But we are glad to say that all, or nearly all, of the men who quote prices in the bee-journals are responsible and honest men, especially those who have been doing business for years; for no commission man can hold his name in the advertising columns of the average bee-journal to-day if there are complaints entered by beekeepers against him. And right in this connection we wish to say that the mere fact that your bank says a certain commission house has good financial rating should not be considered as evidence that the house is also honest. We would rather trust the man who is honest and not responsible than the one who is financially good and yet "up to the tricks of the trade."

At the time you make shipment, send bill of lading to the commission house, and *name price below which the honey must not be sold.* A commission house has no right to sell at a lower figure until you give instructions. Before the honey is packed it should be carefully weighed so that you will know exactly how much honey you have sent. Do not send large shipments at first. If in any case you send honey, and the commission house fails to make returns, or refuses to do so, it is a criminal act. Such house has no right to appropriate your honey without rendering to you some sort of returns; but never take a note in payment from an irresponsible firm or individual; if you do you will be powerless to help yourself; for legally a note is a settlement.

SELLING FOR CASH.

If you can sell for cash, and the party is responsible, by all means do so, providing you can get market prices. Look out for firms wanting to buy for cash with no rating, in Dun's or Bradstreet's commercial agencies. To make yourself secure ship the honey to *your* name at the point of destination, and then send bill of lading to some bank in the city with instructions to turn over bill of lading to purchaser on receipt of cash. Banks will charge you a small fee for doing the business, but you will be safe. The law gives the producer greater protection when his honey is sold on commission than when sold for cash, providing money is not received before honey is turned over. We wish to reiterate the point again: Never deliver honey to a concern on an outright sale or deal till the banks say your man is entirely responsible; *then* if every thing is in writing you are able to collect by due process of law; but if he is irresponsible you will be throwing away good money in trying to do any thing with him in a legal way. For the consideration of cases for holding sections, see Shipping Cases.

HOW TO KEEP COMB HONEY AND AT THE SAME TIME PREVENT IT FROM GRANULATING.

It is sometimes desirable to keep comb honey for a better market, or that we may have a supply the year round, etc. Well, to keep it with unimpaired flavor it must not be subjected to dampness. If water condenses on the surface of the comb it soon

dilutes the honey, and then it sours, etc. On this account the honey should never be put into a cellar or other damp room. Better put it upstairs; and that there may be a free circulation of air, without admitting bees or flies, the windows should be covered with painted wire cloth. We are accustomed to keeping comb honey the year round, and rarely have it deteriorate in the least. The same remarks will, in the main, apply to keeping extracted honey. During damp and rainy weather, the doors and windows of the honey-room or honey-house should be closed, and opened again when the air is dry.

Comb honey should under no circumstances be stored where it is likely to freeze, as freezing contracts the wax so as to break the combs and let the honey run. Mouse-traps should be kept set to catch the first mouse that appears.

Elsewhere under this heading we have drawn attention to the importance of keeping honey stored in a room kept as nearly as possible between 80 and 90 degrees F. It should never go down to the freezing-point at any time—nay, rather, it should never go below 70 *if it is possible to avoid it.* Varying degrees of temperature have a strong tendency to make honey granulate; and nothing ruins comb honey quicker than this.

We made some experiments to see how hot we could keep the room and not have the combs melt down. We find the temperature must not go higher than 103 F. While this may seem excessively high, yet if the honey begins to candy the only way to arrest the process of granulation is to bring the temperature up to 103, and *maintain it there.* Aye, there is the difficulty. We accomplished it by putting steam-coils in the room with sufficient radiation so that the temperature can be held between 101 and 103. If it goes above the high point, an automatic regulator, something on the plan of an incubator-valve, allows the heat to escape. As the temperature drops, this valve closes.

We kept some 2000 lbs. of honey in this room for two months. Some of the honey had already begun to granulate, and it was our hope that we could not only arrest the granulation but bring the granulation back to a liquid condition. In this last we were disappointed, but we succeeded admirably in stopping the process that would have soon ruined this whole lot of honey.

We are not sure but a temperature of 100 F. might do as well, and possibly such a degree would be safer for the average person to use, because, if the thermometer shows higher than 103, there is great danger that the combs will be overheated, sag, and set the honey to leaking.

Perhaps one in a small way might be able to maintain a room hot by the use of a hard-coal stove, from which a regular heat will be given off. In some instances one might use furnace heat. This latter would, perhaps, be advantageous in that it would provide for ventilation and thus hasten the evaporation of any unripe or thin honey. Where natural gas is available and cheap enough, gas-stoves will furnish a more regular heat than any thing else. But certain it is, there must be some sort of automatic regulation of the heat. While the heater can be controlled to a certain extent, it seems more feasible to let the surplus heat escape.

Under EXTRACTED HONEY and BOTTLING HONEY will be found hints on peddling honey and marketing in general. See also PEDDLING HONEY.

For consideration of hive on scales, see SCALE HIVE.

CONTRACTION.—A few years ago contraction of the brood-nest seemed to be all the rage. It was argued that most colonies, Italians especially, after they had put a little honey in the brood-nest, would be disinclined to go above into the supers; and to force them above, some beekeepers took out three or four of the brood-frames below and contracted the brood-nest, and then placed supers on top. This was very pretty in theory, and in practice it *did* force things. It forced the bees into the supers, but more often forced swarming.

Another set of contractionists argued in favor of hiving *swarms* in a contracted brood-chamber. They did not believe in contracting the brood-nest in an established colony; and, therefore, when they contracted at all they did so only during swarming time. This form of contraction will certainly be better than the other; but as the years go by we hear less and less about contraction and more and more about expansion—how to get stocks strong—big, rous-

ing, powerful colonies. An eight-frame brood-nest is usually small enough. Indeed, a ten-frame may be none too big. See HIVES, SIZE OF, elsewhere, for the further consideration of this subject.

COTTON—(*Gossipium herbaceum* L.). Cotton is widely cultivated throughout the Southern States for the hair on the seeds, the manufacture of which into clothing forms one of the most important industries. On the first day after opening, the flowers are pure white or reddish, changing on the second to dark red. There are extra-floral nectar-glands on the floral bracts and on the under side of the leaves on the center rib. This gland seems to be most active at the time the leaf reaches full maturity. When atmospheric conditions are just right, such large drops of nectar will collect on these leaf-glands that one may readily taste it; and a bee has to visit only a very few to obtain a load. At such times they neglect the blossoms entirely, and the honey comes in with a considerable rush. Besides honey-bees the flowers are visited by wild bees, wasps, beetles, and butterflies; while the extra-floral nectaries attract many hummingbirds and great numbers of ants.

The honey-flow usually lasts from July until the first killing frost, yielding in some localities as much surplus as all other sources combined. Even after the first frosts, if there is pleasant weather, the bees may continue for two weeks longer to work upon the plants, and make a considerable increase in the honey crop.

It is but few years, comparatively, since cotton came into prominence as a honey-yielding plant. Years ago cotton honey was hardly known, this being due perhaps to the fact that the honey which the bees obtained from the cotton was attributed to some other source. But of late years, especially when it is grown on rich land, in valleys and river bottoms where the growth is luxuriant, cotton has come to be known as one of the very best honey-yielding plants. It yields best when the atmosphere is warm and damp. On poor soil or sandy land it does not yield nectar plentifully, and in some cases not at all. In the average season a good yield may be expected from cotton in the black land districts and in the river valleys. Under favorable conditions it is not excelled by any other nectar-yielding plant in the cotton belt.

The yield is most abundant in the early morning, and it decreases toward the middle of the day as the atmosphere becomes drier. In the afternoon unless the season is very dry and hot the yield begins to increase again. During cloudy days or when the atmosphere is damp, the yield continues abundantly throughout the entire day.

Cotton honey is very light in color and mild in flavor when thoroughly ripened, and it compares favorably with the very best grades of honey. Honey from upland cotton or that which is grown on poorer soil has a light-amber color. When first gathered cotton honey has a flavor which is very characteristic of the sap of the cotton plant itself, but this disappears as the honey ripens. During a heavy flow there is a strong odor in the apiary like that produced by bruising cotton leaves.

Ordinarily, cotton honey granulates easily, and in the granulated form is almost pure white and very fine-grained.

Barbadoes, or sea-island cotton (*Gossipium Barbadense* L.), is cultivated in Georgia and South Carolina, but is of much less importance as a honey-plant.

CRIMSON CLOVER.—See CLOVER.

CROSS BEES.—See ANGER OF BEES.

CROSSES OF BEES.—See HYBRIDS.

CYPRIAN BEES.—See ITALIANS.

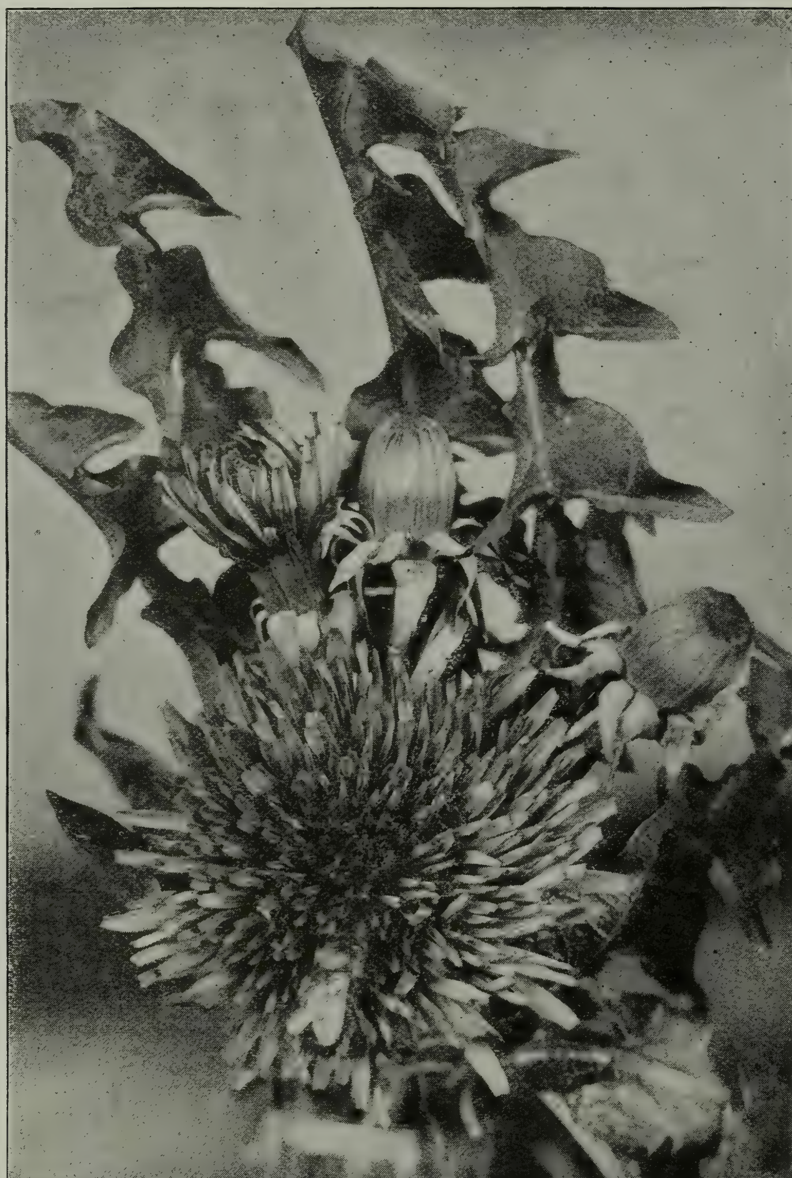
D

DANDELION — (*Taraxacum officinale* Weber). Other English names are lion's tooth, blowball, yellow gowan, and priest's crown. Widely distributed over North America, Europe, and Asia. Coming as it does in early spring, sometimes preceding and sometimes following fruit bloom, and often beginning simultaneously with it, the dandelion is a most valuable plant for bees. It may yield but little honey; but it certainly affords a large amount of pollen in localities where it thrives, for it comes into bloom just at the time of year when bees need farinaceous food for brood-rearing.

A part of a field of dandelion in full bloom, at Medina. This, and other fields like it near Medina, furnish considerable honey and pollen in early spring—just when it can do the most good. We do not find that the plant hurts the hay or pastures in the least.

In some localities the dandelion is much more abundant than in others. Visitors at Medina, for example, often remark about the profuse and vigorous growth. Never saw any thing like it, they say; and the story is told again and again how A. I. Root and his son E. R. used to go about nights spreading the seeds around the country for their bees. Of course, there is nothing in the oft repeated story; but it is true that their bees so thoroughly pollinated the blossoms that every seed, wherever it falls, develops a plant providing it is not choked out by something else.

The accompanying illustration shows something of the rank growth of the dandelion near our apiaries. Many and many a time we have been able to measure dandelion stalks three to four feet long.



A large specimen of dandelion blossom, buds, and leaves—life size. The blossom here shown is larger than the average. The usual size is about two inches across.

The dandelion on the lawn is certainly a nuisance, and its eradication is not easy. Certain chemicals, recommended by our ex-

periment stations, however, may be put on such lawns to destroy large-leaved plants, but not injure the blades of grass. We have never tried them, and do not know what their merit is; but for the farmer the dandelion ought not to be regarded as a noxious weed. Let loose a flock of poultry in a yard containing dandelion and ordinary grass, and in a very short time the dandelion will be conspicuous by its absence. Let a good milch cow into a pasture where dandelion grows, and after she learns to like the plant she will fold her long tongue around a big plant of dandelion, and crunch it as if it were the most delicious thing she ever ate. She will, in fact, select it in preference to any thing else that grows in the field, even ignoring big bunches of timothy grass. And such milk! Just try your cow on a dandelion field.

Our experiment stations too are beginning to recognize that the dandelion is not necessarily the farmers' enemy. It is always held under control with the plow and barrow; and in pastures it yields the most delicious milk for the dairy. We believe the time will come when it will be cultivated, providing town councils do not legislate it out of existence because of the damage it does to the lawns.

If some of our city friends who so eagerly pick out dandelions for table greens could be let loose in some of our Medina fields of golden bloom they would think they had struck it rich. We have fields in and near Medina that would take care of the needs of the inhabitants of quite a large city; and were it not for the expense of travel, no doubt the poor would go into these fields by the thousands.

What is true of Medina is also true of other localities where bees are kept, providing, of course, atmospheric and soil conditions are right.

To keep it out of a lawn, the lawn-mower ought to be sharp and close-cutting, and, in addition, a heavy roller should be used quite frequently. In any case one has to do this to get a fine lawn, even when dandelions are not present.

DAISY.—See Asters.

DEVELOPMENT OF BEES.—The literature on the development of the honeybee available to the beekeeper is scant. This is especially true as regards the development in the egg (embryology) and the metamorphosis. The origin of drones from unfertilized eggs has been much discussed in the journals devoted to beekeeping, but such discussion has as a rule contributed but little to our knowledge of the facts. This condition of affairs is somewhat surprising, considering the attention which has been given to the anatomy of the honeybee, and also that the development in the egg is well known, having been described by the following investigators: Butschli (Germany) in 1870, Kowalevsky (Russia) in 1871, and Grassi (Italy) in 1884. The metamorphosis was described in detail by Anglas (France) in 1900.

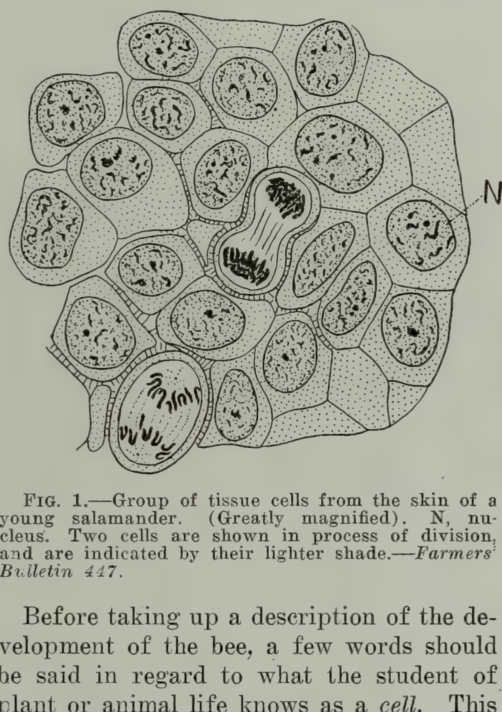


Fig. 1.—Group of tissue cells from the skin of a young salamander. (Greatly magnified). N, nucleus. Two cells are shown in process of division, and are indicated by their lighter shade.—*Farmers' Bulletin 447.*

Before taking up a description of the development of the bee, a few words should be said in regard to what the student of plant or animal life knows as a *cell.* This word has several meanings, but is used here in a restricted and special sense. All plants and animals are, without exception, composed of one or more cells. The cell is the unit of structure, as the brick is the unit of structure of the chimney, or the soldier of the army. Cells are commonly microscopic in size, so that it requires many millions of them to make up even so small an animal as a bee. A group of typical tissue cells is shown in Fig. 1. A cell may be defined as "a mass of protoplasm (living material) containing a nucleus." Both nucleus and protoplasm are interdependent;

neither is capable of continued existence without the other. The nucleus (N) is a body usually more or less rounded in form, containing within it a substance commonly believed to be the bearer of the hereditary qualities of the individual and of the race. Every cell is to a certain extent independent, carrying on its own vital functions, such as the assimilation of nourishment and the emlimination of waste. In addition, in the higher organisms, it usually has a special function; for example, the special function of the liver cell is to secrete bile, that of the nerve cell to transmit nerve impulses. All the cells in an organism are, however, so co-ordinated that the sum total of their activities is a unified whole, that is, an individual, capable, under the proper conditions, of maintaining itself and contributing to the reproduction of its kind. One of the most important properties of a typical cell is that of multiplying by self-division. This division always affects daughter cells, thus each receiving a part of both. In Fig. 1 two cells are in process of division.

On beginning its development every egg is essentially a single cell. In addition to the protoplasm and nucleus of a typical cell, the egg contains also a certain amount of non-living material, *yolk,* which serves as a store of food for the developing embryo. Before it can begin development, the unfertilized egg or female cell must usually be first united with a much smaller and more condensed cell, the *spermatozoon,* or male cell. This cell supplies the male half of the inherited characters and also stimulates the egg into development. This phenomenon is *fertilization.* In certain cases eggs may develop without the stimulus of the spermatozoon, and they therefore inherit their characters only through the mother; this is *parthenogenesis.*

The development of the egg or cell formed by the union of the male and female cells consists in its repeated division, by which many cells, united together, are formed; the shifting and rearrangement of these to form organs and tissues; the gradual appearance of differences between the cells forming the various tissues and organs, so that the cells become changed or modified in accordance with the function which they are to assume.

The egg of the honeybee is shaped somewhat like a banana, and is about 6-100 of an inch long. One end is slightly larger than the other, the egg adhering to the bottom of the cell by the smaller end. The embryo is always formed on the longer or convex side of the egg, its lower or ventral surface directed outward, the head at the larger end. The egg is in appearance pearly white, and slightly translucent. It is covered externally by a very thin but tough membrane whose surface is covered by a delicate network of ridges. The egg of the bee contains a relatively large quantity of yolk, the protoplasm being comparatively small in amount. On this account cell division is restricted to the interior of the egg, the cells thus formed later rising to its surface to form a layer from which all the parts of the future larva are formed.

The first conspicuous evidence of the future embyro is the appearance, during the second half of the second day, of a band-like thickening on the long side of the egg (Fig. 2). On this thickening, at the larger end of the egg the appendages begin to appear as rounded protuberances, the antennae (Ant) and the mouth parts (mandibles and maxillae, Md. 1Mx, 2Mx) being the first to appear. Behind them are the rudiments of the three pairs of legs (L 1, L 2, L 3). At about the same time the rudiments of the stigmata and tracheal system appear as a single row of pits on each side (Sp). The rudiments of the silk or spinning glands (SlkG) also appear as pits just behind the second maxillae. On the upper or dorsal side of the head are also seen two pairs of swellings (Br) which constitute the rudiments of the brain. At this stage therefore nearly all of the important organs of the larva are outlined. The changes leading to the completed larva are illustrated by Figs. 2c and 2d. In Fig. 2c a number of important changes are seen to have taken place. The band-like embryo has widened, growing toward the dorsal or concave side of the egg. The mouth (Mth) and anus (An) appear as deep pits at the two opposite ends of the embryo. They join with cell masses on the interior to form the alimentary canal, the pits forming the fore and hind intestines, the cell masses the mid intestine (Fig. 3, MInt). The mouth parts have changed little, but the upper lip (Lm) is now represented by

a flap-like outgrowth. The Malpighian tubules, MT, the excretory organs of the larva, have arisen as outgrowths of the hind intestine. The pits constituting the tracheal invaginations have enlarged to form sacs, and each of these in turn sends out three hollow outgrowths, two of which extend forward and backward to meet those of the neighboring segments and one of which extends downward to join the corresponding branch in the same segment on the opposite side (Fig. 2, Tr). The pit-like rudiments of the silk glands (SlkGl) have grown backward to form long tubes. The rings or segments of the body are now marked off by constrictions, as they are in the larva. In Fig. 2d the development in the egg is practically completed. The important changes to be noted are: the disappearance of the rudiments of the antennae and legs, the joining together of the second maxillae to form the lower lip; the completion of the tracheal loops (Tr), and the development of the nervous system. The embryo has by this time completely surrounded the egg, closing up the gap on the back, seen in Fig. 2b. The embryo next breaks the egg shell and becomes a larva, the development in the egg having lasted a trifle over three days.

In respect to their later development insects are by some writers divided into two classes—those with a complete metamorphosis, and those with an incomplete metamorphosis. The honeybee is an excellent illustration of the first class, while the grasshopper is an illustration of the second. When the young grasshopper hatches from the egg it is clearly recognizable as a grasshopper, and would never be mistaken for another insect, since it resembles the adult in every important particular except that its wings are only short pad-like structures. Moreover, its food and habits of life are those of the adult, and it faces the same difficulties and dangers. Its development into the adult is simple; it is little more than an increase in size. The honeybee, on hatching from the egg, is however quite a different creature from the adult, being without organs of locomotion (legs), touch, (antennae), or sight (eyes). Moreover, its integument is thin, and not hardened as in the adult. In short, it is a *larva,* which when full grown has to undergo a *metamorphosis* to reach the adult condition. The larval stage is a short cut in development, by which the young insect is enabled to obtain food more advantageously, and, in the case of the bee, is also protected from

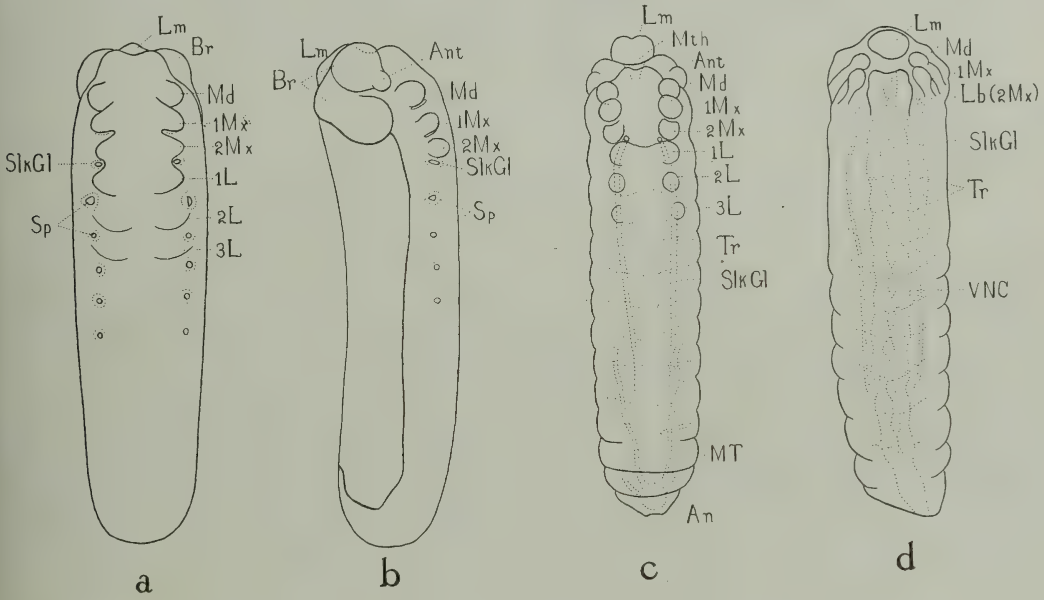


FIG. 2.—Three stages in the development of the egg (greatly magnified). The earliest stage at which the rudiments of the appendages are seen is represented by a and b; a, egg seen from the ventral (lower) side; b, from the right side; c, later stage, showing the development of the mouth parts, silk glands, etc.; d, embryo just prior to hatching, the development within the egg being completed; An, anus; Ant, antenna; Br, brain; 1L, 2L, 3L, thoracic legs; Lb, labium (lower lip); Lm, labrum (upper lip); Md, mandible; MT, Malpighian tubules; 1Mx, 2Mx, first and second maxilae; SlkGl, silk gland; Sp, rudiment of spiracle; Tr, trachea; VNC, ventral nerve cord.—*Farmers' Bulletin 447.*

enemies. The bee larva is especially adapted by nature for rapidly digesting and assimilating food. As Fig. 3 shows, its mid-intestine or stomach occupies the greater portion of the body of the larva. As one beekeeper expressed it, "a larva is all stomach." For this reason, and because of the rich and easily digested food supplied by the worker bees, and also because the

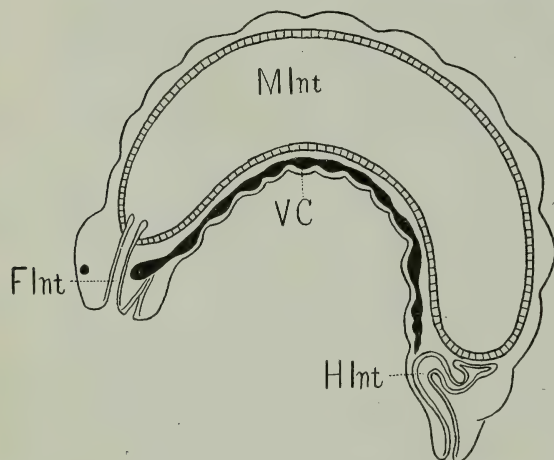


FIG. 3.—Diagram of a longitudinal section through a larva, FInt, fore intestine; HInt, hind intestine; MInt, mid intestine; VNC, ventral nerve cord.—*Farmers' Bulletin 447.*

young or larval bee is not required to use up any energy in escaping enemies or in obtaining food, all its energies being bent on eating and growing, it is enabled to complete its growth in a short space of time. This is accomplished, in the case of the worker bee, in a little less than five days. When the larva is first hatched it lies bent in the form of the letter C, on the bottom of the cell. As it grows it curls up tighter and tighter, until after about three days it becomes too large to lie at the bottom of the cell; it then uncurls and lies lengthwise of the cell. During the first three days of the larval stage of the worker bee, and during all of the larval stage of the queen, it is fed a highly nitrogenous food produced by the nurse bees. The origin of this food, whether it is a secretion from special glands of the nurse bees, or is regurgitated from their stomachs, is not at present known. It is generally believed that after the first three days, however, the worker bees are fed honey and pollen. When the larva has attained its full size, which in the case of the worker bee occurs after about five days, it is sealed up in its cell by the worker bees, which place a thin cap of porous wax over the mouth of the cell. Next the larva itself lines this cap, including also the outer end of the cell, with a thin web of silk secreted by the silk glands (Fig. 2c and d SlkG). About three days after sealing, the larva undergoes a moult. At the same time a connection between the mid and hind intestines is established, and the residue of the food digested during the larval period is evacuated. The larva has now become a *semipupa* or *pronymph.* The semipupa is motionless, and nearly always lies on its back with its head toward the mouth of the cell. Its form is much like that of an old larva (Fig. 4c). If touched it seems soft and pulpy; and if an attempt is made to remove it from the cell, it will be found very delicate and easily ruptured. In the worker the semipupal period lasts about one day when another moult occurs, and the semipupa becomes a pupa, with the form and all of the parts of the adult bee. On the eleventh day after hatching, the eyes begin to turn from white to pink, which color later turn to reddish brown, and finally, on the sixteenth day, to black; the thorax at the same time becomes a light yellowish brown. On the nineteenth day after hatching the development is complete, the young bee sheds its pupal skin and gnaws its way

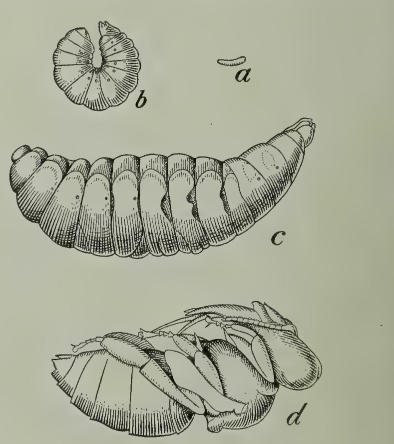


FIG. 4.—Four stages in the development of the honeybee; a, egg; b, young larva; c, old larva; d, pupa.—*Farmers' Bulletin 447.*

out of the cell. The duration of the larval and pupal stages in the development of queens and drones are different from those of the worker.

It is evident that, during the period after the larva is sealed up in the cell, the developmental changes which it undergoes must be active and radical indeed in order to bring forth a creature as different from the larva as is the adult bee. The following is only a brief sketch of these complex processes. In general they involve a tearing down and rebuilding of many of the tissues of the bee as well as the coming into activity of portions of the larva which have been dormant ever since it left the egg, or even before this time. To the former category belongs in particular the alimentary tract, which is literally torn down and cast away, being replaced by new cells. To the latter category belong the legs, wings, and eyes, which are developed from groups of cells whose activities have been held in abeyance during the larval period. These are formed from growth centers of the body wall which are formed before the larva hatches from the egg, but which are quiescent during the growing period of the larva. After the larva is sealed up these rudiments are roused into activity. The legs and wings are formed in pockets of the body wall, and, after the moult of the prepupal skin, are pushed out by blood pressure from the interior, as the fingers of a glove may be pushed out by blowing into them. The muscles of the larva are partly torn down and replaced by new muscles, and partly persist as the muscles of the adult. The changes undergone by the nervous system and the tracheae are much less radical. All these changes consume energy, which is shown by the fact that there is a considerable loss of weight during the pupal period. This energy is stored up in the larva largely in the form of fat, contained in the fat-body which surrounds the mid-intestine.

DISEASES OF BEES.—A few years ago it was considered that bees were freer from disease than perhaps any other class of animated nature, for the reason that individual members of the colonies were so constantly giving way to the younger ones. But this has been shown to be, to a great extent, a mistake; for apparently there are at least three or four distinct diseases with which the beekeeper has to contend; and it is well for the beginner to have an idea, at least, of what they are like; for the time to cure a disease of a contagious character is to take it at the start, or, better still, take precautionary measures such as will prevent its making even a *beginning.*

HOW TO AVOID DISEASE.

Contagious diseases spread very rapidly among bees, just as they are inclined to make rapid headway in crowded centers of the human family. Unfortunately, bees are disposed to rob from each other during a dearth of honey; and if the germs of disease or infection reside in the honey they may be scattered over the entire apiary in a few days . An infected colony is naturally weakened and discouraged, and as a result the bees do not make the defense that they would under normal conditions. During a dearth of honey the healthy bees all over the yard are quite disposed to rob the weak or sick ones, so that the infection is scattered right and left.

One of the best precautions against disease is good food, and keeping all colonies strong. A healthy human being is much more able to resist the germs of infection than one who is "all run down." A person, for instance, is not likely to come down with typhoid unless his syystem is greatly reduced.

TWO CLASSES OF DISEASES.

The diseases with which the beekeeper has to contend may be divided into two classes—those that affect the mature flying bees, and those that attack the brood. The latter are considered under Foul Brood.

Among the diseases that attack the mature bees may be mentioned "spring dwindling." This, perhaps, should hardly be considered a disease, but it is a malady with which he have to deal. For particulars regarding it see Spring Dwindling. Still another trouble is dysentery. This in some cases may be a germinal disease; and in most cases assumes the nature of an ordinary diarrhea. See Dysentery. The only disease of any account now remaining that affects adult bees is—

BEE-PARALYSIS.

This is a disease that is much more prevalent and virulent in warm than in cold climates. Almost every apiarist in the North has noticed at times perhaps one or two colonies in his apiary that would show bees

affected with it. Yet it seldom spreads or makes any great trouble; but, unfortunatenately, this is not true in some parts of the South and West. In the South it is known to affect whole apiaries, and seems to be infectious.

SYMPTOMS.

In the early stages an occasional bee will be found to be running from the entrance, with the abdomen greatly swollen, and in other respects the bee has a black, greasy appearance. While these sick bees may be scattered through the hive, they will sooner or later work their way toward the entrance, evidently desiring to rid the colony of their miserable presence. The other bees also seem to regard them as no longer necessary to the future prosperity of the colony. In fact, they will tug and pull at them about as they would at a dead bee until they succeed in getting them out in the grass, where the poor bees seem willing to go and die alone.

Another symptom is, that the bees often show a shaking or trembling motion. In the earlier stages, this peculiarity does not appear; but later on it manifests itself very perceptibly.

TREATMENT AND CURE.

In some cases destroying the queen of the infected colony, and introducing another from a healthy stock, effects a cure. This would seem to indicate that paralysis is constitutional, coming from the queen; but in the South, where the disease is much more prevalent and destructive, destroying the queen seems to have but little effect. Spraying the combs with a solution of salt and water, or of carbolic acid and water, has been recommended; but these do little or no good. One writer recommends removing the diseased stock from its stand, and putting in its place a strong healthy one. The affected colony is then removed to the stand formerly ocupied by the healthy bees. He reports that he tried this in many cases, and found that an absolute cure followed in every instance. The *rationale* of the treatment seems to be that the bees of the ordinary colony having bee-paralysis are too much discouraged to remove the sick; as a consequence, the source of infection—that is, the swollen, shiny bees—are allowed to crawl through the hive at will. But when the colonies are transposed, the healthy vigorous bees of the sound stock carry the diseased bees entirely away from the hive. The sick and the dying being removed, the colony recovers.

Mr. O. O. Poppleton, of Stuart, Fla., has had a large experience. One plan that he uses is as follows:

He sprinkles sulphur over the affected bees and combs, but not until all the brood in the diseased colony has been removed and put into a strong healthy one; for Mr. Poppleton says the sulphur kills all unsealed brood and eggs; that no harm results in putting the brood among healthy bees, as he finds the source of the malady is not in the brood or combs; for he has put combs from paralytic colonies repeatedly into healthy ones, and never (but once) did the disease develop in any such colony, and that was a year afterward.

At first, says Mr. Poppleton, the disease seems to get worse instead of better. The colony will dwindle, but in two weeks there will be a decided improvement, and finally the colony will be cured and will stay cured. In many cases, he thinks, it may be necessary to repeat the application of the sulphur about ten days after the first time. This makes sure that every bee has received a curative quantity of the sulphur, even if it were not in the hive at the first dose.*

While the foregoing has worked well, yet because it is attended with a rapid reduction of the strength of the colony so treated, and because the disease has a tendency to run in certain strains that are very susceptible to it, Mr. Poppleton thinks that, in the long run, it may be better to use the following plan: He forms as many nuclei from strong healthy stocks as there are sick colonies to be treated. As soon as the nuclei have young laying queens, he gives to each, as fast as they can take care of them, one or two frames of the oldest capped brood from each of the paralytic colonies, and thereafter till all the brood of such colonies is used up. The diseased bees and queen he next destroys with sulphur fumes, fumigating the hives at the same time.

BEE PARALYSIS IN AUSTRALIA; DEVELOPING A STRAIN OF BEES IMMUNE TO IT.

As already mentioned, bee paralysis seems to be more virulent in hot climates than in cold ones; and it also appears that

* Always dust the sulphur on in the evening.

some strains of bees are less immune to it than others. Mr. R. R. Beuhne, of Toobe-rack, Australia, one of the most extensive beekeepers of that country, has had a very large experience with it. In some parts it is very destructive. But Mr. Beuhne has it well under control by developing and propagating a strain of vigorous leather-colored Italians. The yellow strains he does not find to be very resistant to the disease. It appears that, by paying careful attention to breeding, the tendency to contract this disease may be almost entirely eliminated, and Mr. Beuhne has succeeded. On one occasion he had shipped into his locality 50 colonies, and almost immediately every one of them became badly affected. By killing off the queens and introducing his own stock he cured the disease.

Repeated tests have shown that paralysis is never transmitted by the brood or combs, but that it is carried by the dead or sick bees. It is, therefore, important that, in giving the combs to the nuclei, there be no dead bees in the cells.

If not convenient then to use the nucleus plan, replace the old queen and use the sulphur. The two other diseases, American and European foul brood, will be considered under FOUL BROOD.

ISLE OF WIGHT BEE DISEASE.

Quite an extended bulletin has been issued on this disease in England. Some think it is nothing more nor less than bee paralysis. It is believed that stagnant water has something to do with it. At the present time there seems to be no definite cure known. Investigations are now under way on the part of the Bureau of Entomology, Department of Agriculture, Washington, D. C., to determine the cause and cure of bee paralysis and all kindred diseases. The reader of these lines will do well to write to the Bureau.

DIVIDING.—Under the head of ARTIFICIAL SWARMING, INCREASE, NUCLEUS, and SWARMING, we show various methods of dividing. But dividing, as it is ordinarily understood, has to do with the operation of increasing the number of colonies or stocks by taking part of the frames and adhering bees, with or without a queen, and putting them in another hive on another stand. Generally speaking, dividing is unscientific and wasteful, while artificial swarming or division on the plans described under NUCLEUS and INCREASE *are* scientific and profitable because they are worked in such a way as to secure a honey crop as well as an increase in the number of bees or colonies. Dividing may be performed so as to ruin all chances of a honey crop, and in addition leave the apiary with a lot of weak nuclei in a totally unfit condition to go into winter quarters, for it is an axiom in beekeeping that one good strong colony will secure more honey than that same colony unintelligently split into halves and put on two different stands.

DOMESTIC ECONOMY OF THE HIVE.—See BEE BEHAVIOR; also DEVELOPMENT OF THE BEE.

DRONES.—These are large noisy bees that do a great amount of buzzing, but never sting anybody, for the very good reason that they have no sting. The beekeeper

Drone bee enlarged seven times

who has learned to recognize them, both by sight and sound, never pays any attention to their noise, but visitors are many times frightened by their loud buzzing. We will commence as we did with the worker-bees, at the egg, and see how much we can learn of these harmless and inoffensive inmates of the beehive.

If our colonies are prosperous, we may find eggs in the drone-comb of some of the

best hives as early as March, but not, as a general thing, until April. You can tell the drone cells from the worker at a glance (even if you have never seen them) by the size, as you will see by looking at HONEY-COMB. Whenever you see eggs in the large cells, you may be sure they are drone-eggs. We do not mean by this that the eggs that produce drones look any different from any other eggs that the queen lays, for in looks they are precisely the same. They are almost the same in every respect, for the only difference is that the eggs that produce the worker-bees have been impregnated, while the others have not; but more of this, anon. The egg, like those producing workers, remains brooded over by the bees until it is about three days old, and then by one of nature's wonderful transformations is gone, and a tiny worm appears, a mere speck in the bottom of the cell. This worm is fed as before, until it is about a week old, and is then sealed over like a worker larva, except that the cap to the cell is raised considerably more; in fact, the cappings very much resemble a lot of bullets laid closely together on a board. The young drones will begin to cut the caps of these cells in about 24 or 25 days; the caps come off in a round piece, very much like those from a queen-cell.

The body of a drone is hardly as long as that of a queen, but he is so much thicker through than either queen or worker that you will never mistake him for either. He has no baskets on his legs in which to carry pollen, and his tongue is so unsuited to the gathering of honey from flowers that he might starve to death in the midst of a clover-field in full bloom.

We presume the young drones are ready to leave their hive after they are about two weeks old, and they do this shortly after noon, of a warm pleasant day. They come out with the young bees as they play, and first try their wings; but their motions are far from being graceful and easy, and they frequently tumble about so awkwardly that, as they strike against your face, you might almost think them either drunk or crazy. We do not know how we can very well decide how old a drone must be to fulfill the sole purpose of his existence, the fertilization of the queen, but should guess anywhere from three weeks to as many months. Perhaps they seldom live so long as the last period named, but we think they sometimes do. Many facts seem to indicate that they, as well as the queen, fly long distances from the hive—perhaps two miles or more. We have now satisfactory evidence that the meeting between queens and drones takes place not very high up from the ground. Several observers have reported having seen this meeting not far from the hives, during the swarming season. The queens and drones sally forth during the middle of the day, or afternoon, and in from fifteen minutes to an hour, or possibly a couple of hours, the queen returns with a white appendage attached to the extremity of her body, that microscopic examination shows to be the generative organs of the drone. These facts have been observed by hundreds of beekeepers, and are well authenticated. In attempts to have queens fertilized in wire-cloth houses, we have, after letting the queens out, seen the drones pursue them until both parties vanished from sight. Still another fact: If you take a drone in your hand some warm afternoon just as he has sallied from the hive, and press him in a certain way, he will burst open something like the popping of a grain of corn, extruding the very same organ we find attached to the queen, and dying instantly.

The manner in which the meeting of the drone and queen takes place has been witnessed a great many times. We give here the statements of a few observers.

The Rev. Mr. Millette, of Whitemarsh, Pa., appears to have been the first who witnessed the actual encounter. The following communication from his pen, which we copy from the *Farmer and Gardener* for November, 1899, settles the important fact, as it came under his observation in the preceding summer:

DRONE AND QUEEN BEE.

In the month of June. an old stock threw off a *second* swarm in which there were four queens. During the process of hiving, one of the queens was observed on the wing, and in a moment was seized by a drone. After flying about a rod they both came to the ground in close contact; the writer instantly followed them up; and as the drone was about departing (having broken loose), seized both the bees, the queen in one hand and the drone in the other. They were taken into the house and left at liberty to fly, when the queen flew to the closed window; but the drone, after crawling about on the hand, was laid upon the window-seat, and in a very few minutes expired. Both the queen and drone had a milky-white fluid upon the extremity of the abdomen, and upon pressing the drone there was no indication of his possessing the specialty of his sex.

To this we append the following extract of a letter writen by Mr. S. B. Parsons (recently dead), of Flushing, New York, confirmatory of the foregoing. He was the introducer of the Italian bee into this country.

He says (*American Bee Journal*):

One fact in our last summer's experience will interest the readers of the *Journal*. The copulation of an Italian drone and queen, upon the wing, was witnessed in my apiary by Mr. Carey and Mr. Otis. They saw the queen issue from the hive, and circle round, when the drone struck her (both being upon the wing). A sharp snap ensued; the drone fell to the ground, and was picked up dead. The queen fell in the grass, rose again, and entered the hive. Mr. Carey soon searched for her, found the workers cleaning her off, and the male organs attached to her body.

Later Mr. Carey related his own account of the occurrence, which we submit in his own words:

About three o'clock P. M., on the 8th of July, I saw a young Italian queen enter her hive without any sign of impregnation. She came out again in a few minutes, and I closed the entrance to the hive. During her absence, which lasted thirteen minutes, three drones came in front of the hive, and, finding the entrance closed, kept on the wing most of the time. When the returning queen was about three feet from the entrance, one of the drones very rapidly flew to her, and, clasping his legs about her, caused her to settle a little to come in contact with a long spear of grass. At the same time an *explosion* was distinctly heard, and they immediately separated—the drone falling to the ground perfectly dead, and having his abdomen very much contracted. The queen, after making a few circles in the air, entered the hive with the male organs of the drone attached to her. All these facts were witnessed by myself and Mr. R. C. Otis, of Kenosha, Wis., as we were seated on opposite sides of the hive, not more than six feet apart, so that there can be no possible ground of mistake.

In later times a correspondent in *Gleanings in Bee Culture* thus describes the act:

MATING OF THE QUEEN AND DRONE ON THE WING, AS SEEN BY AN EYE-WITNESS.

On June 21, 1888, I saw this mating take place. The queen issued from the hive, took two circles, and came within five feet of my face, and was there met by a drone. They semed to face each other, clinging by their fore legs, their bodies being perpendicular, and in this shape flew from my sight. It happened so unexpectedly that I hardly knew what was going on before it was too late to follow them. I could have easily kept up with them. I have described this because your book says they have not been seen, only as they were whirling about each other. I saw these fasten; and as they did so they turned and came together, square up and down; and as they flew away their bodies inclined about like this / and each bee was using its wings.

Myrtle, Pa. E. A. PRATT.

One of our former apiarists, now Dr. W. I. Wood, lately told us he had seen the drone and queen come in contact face to face, exactly as Mr. Pratt describes.

Another correspondent reported the one thing yet unobserved; viz., the manner of separation of the queen and drone. He described it as follows:

I was going out to my bees one day, when two bees came whirling down in front of me and fell on to a pumpkin leaf. It proved to be a queen and drone. The drone acted as if he had been stung by a worker. He held fast to the leaf with his feet, and the queen keep whirling over and over, about as a fly would if caught in a spider's web, until she freed herself, then she flew out of sight in an instant, and the drone remained where he was on the leaf, but showed life for only about three minutes.

Onawa City, Ia. S. R. FLETCHER.

The late E. L. Pratt, of Swarthmore, Pa., a queen-breeder of note, in *Gleanings in Bee Culture* for 1904 thus wrote:

I have this day witnessed the act of copulation between a queen and a drone. About 2:30 o'clock on the afternoon of Thursday, July 21, I was standing near a fertilizing-box filling a feeder when my attention was attracted by an unsual commotion in the way of extra loud buzzing, as of drones on the wing. I looked and saw a queen rapidly flying toward the fertilizing-box, evidently her home. She was closely followed by two drones, one of which turned and flew off, but the other remained in pursuit. They were flying not six inches from the ground, and were not over eight feet from the fertilizing-box when the act took place. It was done so quickly that I marveled at it, and I wish here to record the facts as I witnessed them. I could not see that the queen was flying in any but the usual way when returning to her hive, but the drone was unusually swift of wing. They were both flying rapidly; and as they flew the drone made two circles about the queen as though to head her off; and as these circles were made about the queen she rose slightly each time. Directly after making the second circle about the queen the drone flew at her as a worker with the intention of stinging in earnest. His abdomen was curved, and his wings rattled in about the same manner. Directly the drone was in contact with the queen there was a sudden lurch sidewise, and they went together some distance into the field until I lost sight of them. As they flew together they much resembled workers when they attempt jointly to bear off their dead. I remained by the fertilizing-box perhaps three minutes, and saw the queen return and enter, bearing the marks of having met a drone. I still lingered by the box, and soon saw a worker bear out the telltale white speck. I later opened the box, and saw the queen bearing the usual thread from male contact. A queen-bee is very swift of wing; but I am convinced that a drone is ten times swifter; for to be able to encircle the queen in the manner this one did, such must be the fact.

In the fall of 1876 we saw a swarm of black ants sporting in the sunshine. A close look showed them to be both males and females; and as pair after pair fell to the ground, we had ample opportunity of noting all circumstances. In this case the drones at first seemed paralyzed; but after the queens flew away, they revived and subsequently flew away also. One point here particularly impressed us: The ants of both sexes were in such countless thousands that they must have come from all

the ant-hills for, we should say, miles around; the result was, as you see, that there was hardly a possibility of insects from the same family meeting. Now, is there any other way in which the strain of blood could be so effectually crossed with that of some distant colony as by this huge jubilee of both sexes in the air?

Queen-ants, like queen-bees, seldom if ever come out of their homes at any other time, and, as if by some preconcerted arrangement, they meet and mix up apparently for the very purpose of effectually preventing "in-and-in-breeding," as it is usually termed when applied to stock. Do queens and drone-bees meet in the same way, in vast numbers? There seems to be no doubt about it, as all known facts point that way. Drones have been seen in places in larger numbers than we would think could possibly come from one hive; and many have heard their loud humming who have not seen them. The fact that a queen should become fertilized in so short a time after leaving the hive seems strange, unless it really is a fact that she is called to the swarm of drones by their loud humming, which she would instinctively recognize from a long distance. Flying among them she meets the drone face to face, falls to the ground, tears herself loose from her dead mate by whirling, and then returns to her hive, having been absent only a few minutes.

DOES THE DRONE HAVE ONLY ONE PARENT?

One of the most wonderful things about the drone, or male bee, is that it is hatched from an egg that is unimpregnated. So wonderful indeed is this that the matter was for ages disputed, and is even now, by many who have not looked into the matter and examined the evidence. What we mean by unimpregnated is, that queens that have never met the male bee at all will lay eggs, and these eggs will hatch, but they always produce drones, and never workers. Those who have had the care of poultry are well aware that the hens will lay eggs right along, if no cock is kept in the yard at all; and, if we are not mistaken, a pullet would commence and lay her full quota of eggs, if she had never seen a male bird. Now, nearly the same is true with regard to the queen-bees. If she fails to meet a drone during the first thirty days of her life (if the bees do not kill her before) she usually begins to lay eggs; but she seldom lays as many, or with the same regularity, as a fertile queen. The eggs a hen lays, if she is allowed to sit, never produce any chicks at all. The eggs laid by a queen, under the same circumstances, as we have said before, always produce drones. There is one more fact connected with the common fowl: If a male bird is put into the yard with the hen for one day only, good fertile eggs will be laid for many days, possibly a whole laying. If a Black-Spanish cock should get among a flock of white hens for a single day, all the eggs laid for many days afterward will produce chicks with more or less black feathers on them. We give these statements from actual facts. The point we wish you to observe is that the eggs of even the common fowl are fertilized as they are laid by the hen, or possibly a few days before. With the fowls, one meeting with the male bird suffices for the fertilization of an egg daily, for a week or more; with the queen-bee, for her whole life of three or even four years.

We do not know whether the hen has the power of laying fertile or unfertile eggs at will or not; probably not; but we do know that a queen-bee lays both fertilized and unfertilized eggs, alternating from one kind to the other in rapid succession. Skillful microscopists have carefully dissected eggs from worker-cells, and found the living spermatozoa in numbers from one to five. These living spermatozoa were precisely identical with those found in dissecting a mature drone. Again: Every egg a queen lays passes a little sac containing a minute quantity of some fluid; the microscope shows that this fluid contains thousands of these spermatozoa. Is it not wonderful that these spermatozoa should live four years or more in this little sac, awaiting their turn to be developed into a higher life whenever they should be required to fertilize the egg that is to produce a worker-bee? Very well; now the egg that is taken from a drone-cell contains no trace of spermatozoa. Therefore it, like the unimpregnated egg of the common fowl should never hatch. Strange to say, it *does* hatch, and produce the drone. The first glimpse we get of the little bit of animated nature is the tiny speck alive at the bottom of the cell. Does he grow out of nothing, without parentage, at least on the paternal side? If his mother

was an Italian, he is also an Italian; if a black queen, he is also a black. We shall have to conclude, perhaps, that he is the son of his mother, and nothing more. The egg that has never been impregnated in the usual way, must, after all, have some living germ incorporated in its make-up, and this germ must come only from the mother. The great skill and proficiency with the microscope, required to make these minute examinations, is such that but one or two have ever succeeded in exploring as far as we mave mentioned, and it is somewhat like our investigations in the polar regions. Who among us will educate himself for the work and carry it along?

Drones are also hatched from eggs laid by worker-bees. These drones are usually smaller in size than those from a queen because they are generally reared in worker-cells, and the question as to whether they are capable of fertilizing queens, so as to be of some value, like other drones, is one that we believe has never been decided. Some facts have been brought to light that seem to be pretty good evidence on both sides of the question; but, so far as we know, nothing very definite. We confess that we should not want to make use of them, even if they were good, for we want the strongest, healthiest, and largest drones we can get. For a further account of the mothers of these queer drones, see LAYING WORKERS.

After what we have said, you will perhaps see how clear it is that the drones are in no way affected by the fertilization of the queen; or, in other words, that all daughters of a purely fertilized Italian queen produce drones absolutely pure whether they have been fertilized by a black drone or not.

Until the invention and general adoption of foundation we had no easy way of repressing the production of drones in far greater numbers than could ever be desirable. Since the introduction of foundation, however, it is found to be quite an easy matter to make almost every cell in the hive a worker-cell. On the other hand, if we choose we can have a hive entirely filled with drone comb, and a good queen could, we think, be induced to raise nearly, if not quite, a full quart of drones at a time. By this means we can have our drones raised from such stock as we choose, and we can save the vast amount of honey that has so long been wasted by rearing and feeding drones that we do not need. While extracting, we have found as many as several pounds of drone larvæ in a single hive; and, to save the honey they would consume as soon as hatched, we used to shave their heads off with a very sharp knife. This is certainly rather expensive business, for it must take more than a pound of honey, to say nothing of the value of the pollen, to get up a pound of sealed brood. If all this labor and material had been utilized in the production of worker-brood, it would doubtless have been equivalent to a swarm of bees. All-worker comb would have insured this without trouble.

This general subject is covered in a more technical article entitled PARTHENOGENESIS elsewhere in this book, and also under head of QUEENS.

HOW TO MAKE BEES BUILD ALL WORKER COMB WHEN ONLY STARTERS ARE USED.

Where one can not afford the expense of full sheets of foundation it is well to know how to make the bees eliminate all drone combs. Mr. E. D. Townsend, of Remus, Mich., tells in *Gleanings in Bee Culture* how this may be accomplished.

The secret seems to be in having just the right number of workers and just the right amount of honey coming in, so that the bees will draw out the combs no faster than the queen can occupy them with brood. As long as this condition lasts we should expect the bees to build worker combs. From this we see that, in order to get good results in comb-building from a natural swarm, this swarm should be of just the right size, and there should be a honey-flow of, say, three or four pounds a day.

We will suppose a large swarm is hived during a period when honey is coming in freely. At this time there is too much honey coming in for the best results in comb-building in the brood-nest, if the whole force of workers is compelled to do all their work in the brood-nest. The remedy is to put most of the workers at work in the supers. Most beginners fail in doing this; but the principle is to make the surplus receptacles more inviting to the workers than the brood-nest, and the bees will immediately go up into the supers on being hived. Our comb-honey super with extracting-combs at the sides make an ideal arrangement for this very thing.

It is plain to see that, if most of the honey being carried in is placed in the sections, where it should be, the queen will not be hurried to keep pace with the workers, consequently nearly all-worker comb will be built. The brood-nest should be filled with comb during the first 23 days after the swarm is hived, for the queen must keep up with the workers and lay in nearly every cell as fast as it is drawn out, or the bees will begin to store honey in the cells. When this condition arrives, the bees, on the supposition that the queen has reached her limit, and that the rest of the combs will be used for storing honey, begin to build the storage size or the drone-

cells in the brood-nest. This is likely to occur in about 23 days after the swarm is hived; for by this time the brood is beginning to hatch out in that part of the hive where the laying began. From this time on the queen has nearly all she can do to keep the cells filled with eggs where the young bees are hatching. This means that the comb-building part of the hive is neglected, and that the bees build store or drone comb to a great extent until the hive is filled.

There are artificial ways of handling bees so that they will build good worker combs. I refer to the plan of shaking the bees into an empty hive, in the same way that a swarm is hived. If a colony is divided into nuclei of, say, two or three combs each, and each nucleus given a young queen reared the same year, such little colonies will build very nice worker combs; but the beginner will not be interested in this artificial way of making increase, for he should stick to the natural-swarming plan for his increase until such time as he has had experience and made a success of getting a crop of honey. In fact, there are many things to be learned before a beginner should take up artificial ways of making increase.

REARING DRONES OUT OF SEASON.

This is quite a difficult matter to accomplish, especially in the spring; and although we have many times fed colonies with this end in view, we have always found some other colony that would have drones flying just as soon, without any artificial aid. Drones may be kept almost any length of time by making the colonies containing them queenless, or by putting them into queenless colonies. During warm dry weather in the summer or fall, drones may be procured by feeding, but the feeding must be regular, and given every day for several days or weeks. By feeding one colony a barrel of sugar in the fall, we succeeded in getting a nice lot of drones in October. Of course their combs were taken away and empty ones given them, to give the queen room. Before we can raise drones, we must get worker brood under good headway, and then, if we put a drone comb right in the center of the nest, the queen will, if all things are favorable, begin at once to fill it with eggs; but it should be observed that a two or three year-old queen is better for the work than a young one. The feeding must be kept up, however, for bees are very easily discouraged; and if a stoppage occurs in the daily supplies, they will not hesitate to pull the young drones out of their cells and sacrifice them without mercy.

DRONES FROM DRONE-LAYERS.

Queen-breeders find that one or more drone-layers of good stock rearing fully developed drones, if supplied with plenty of worker brood, will furnish a fine lot of nice drones in and out of season; but drones from laying workers, or from queens that have never been fertilized, are to be avoided. Drones from queens that have once laid worker eggs, and then failed, are as good as the drones from any queen.

DESTRUCTION OF DRONES IN THE FALL.

This does not necessarily occur in the fall, but may take place at any time in the summer; and we have several times known the drones killed off between apple-bloom and white clover, only because supplies ceased, causing the bees to become discouraged and give up swarming for the time being. We know of no way in which one can tell so well that the yield of honey has ceased, as by the behavior of the bees toward their drones. When, in the midst of the honey season, we see a worker buzzing along on the back of a drone that seems to be doing his best to get away from the hive, we may take warning that the yield of honey is failing, and that we had better stop making artificial swarms, and prepare for feeding, if it is our intention so to do. We do not know that we ever saw bees sting drones, but they sometimes pretend to do so. It is probable that it is only a feint to drive them away. The poor drone, at such times, after vainly trying to go back into the hive, will sometimes take wing and soar away off in the air, only to return after a time to be repulsed again, until, through weakness perhaps, and want of food, he flutters hopelessly in the dust, and so submits to the fate that seems to be a part of the inexorable law of nature and of his being.

To preserve drones for late queen-rearing, we have been in the habit of carrying all frames containing drone brood to some queenless hive, knowing they would be safe there as long as wanted, even if it were all winter. We believe drones have been, under such circumstances, wintered over; but whether they are of any value in the spring or not, we are unable to say. We should fear they would not be by the time queens could be reared. We usually have drones in some of our colonies as soon as April, and that is as early as we should care to undertake to rear queens, in ordinary seasons. We have several seasons reared queens and had them successfully fertilized, even after all the drones had been gone some time, so far as we could discover; and as

they proved to be purely fertilized, we have been not a little perplexed.*

DRONES WITH HEADS OF DIFFERENT COLORS.

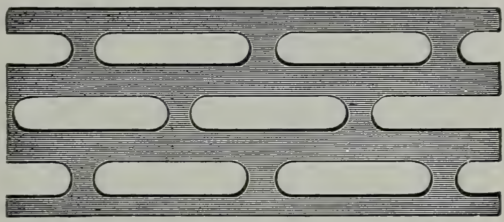
This is a queer feature in natural history. Almost every summer some one writes or sends us specimens of drones with heads of different colors. The matter has been reported and commented on at different times in *Gleanings in Bee Culture.* Not only do we occasionally find drones with white heads, but we find them with heads of a cherry-red color; again, of a bright green, and at other times yellow. We confess there is something very wonderful and mysterious to us in this matter. Why queer old dame Nature should decide to single out the heads of drones to sport with in this way will, it seems to us, be a rather difficult matter to explain. Why should this peculiarity show itself in the drones more than in the queens and workers? Again, why should *heads* be the subject of these bright rainbow colors? Is there really any purpose or design in it? or is it just because it *happened* so? We presume there are very few among our readers but will say there is a purpose and a design in it; and the next thing is to decide why it should be so. Here is a conundrum.† See HERMAPHRODITE BEES.

RESTRAINING UNDESIRABLE DRONES.

Drones undesirable for breeding purposes may be prevented from going out to meet the queens, by keeping them from going out of the hive, or by letting them go out into a cage through which workers can pass and they can not. This is done by taking advantage of the fact that a worker-bee will pass readily through slots in perforated metal (or between bars properly spaced) where a drone can not. In the figure shown we give the form of the perforated metal.

THE PROPER SIZE FOR THE PERFORATIONS.

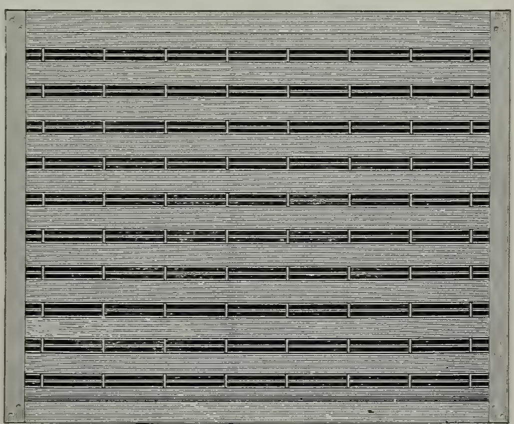
The oblong holes, as shown below, must be of such a size as to permit the easy passage of workers, but exclude not only drones but even queens (see COMB HONEY and SWARMING). It is no great task to make the perforations drone-excluding; but to make them *queen*-excluding at the same



Perforated zinc.

time, and yet not hinder the easy passage of workers, requires a very nice adjustment in the width of the perforations. The first sheet of perforated zinc was cut in England, and imported to this country. This had perforations 18-100 of an inch in width. While this answered a most excellent purpose, a few claimed that queens would occasionally get through it. To obviate this, zinc was made with the perforations a little narrower.

The width of this was 5-32 or 16-100 of an inch. While no queen succeeded in getting through this, reports, as well as our own experience, convinced us that this size was too narrow. It not only proved to be a great hindrance to the workers when their honey-sacs were empty, but, when gorged with honey, they were scarcely able, if at all, to pass through. Later, perforated zinc was made in this country on a different pattern, but with perforations exactly 165-1000 of an inch in width, or a *trifle* smaller than the foreign. The reports, as well as our own experience in regard to the perforated zinc as so made, have led us to believe that this size of perforations is about right.



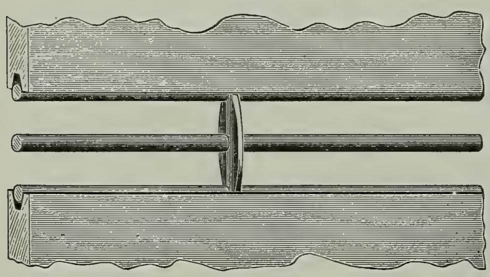
Wood and wire honey-board.

In 1908 there was put on the market a

* It is not very unusual for a colony to tolerate a few drones late into the fall or even into winter, and this, too, with a young and fertile queen.—A. C. M.

† These colors are explained by the reflection and refraction of light, pigment being absent from the eyes of such drones. Why one head should give back only the red rays and another only the green we know not.—A. C. M.

new form of queen-excluder* consisting of wire bars held at the required distances apart by means of soft-metal cross-ties at every two or three inches. These bars consist of No. 14 hard drawn galvanized wire that has been straightened in a wire-straightener so that it is true as a die. Contrary to what one might expect, the spaces between these bars are more exact than the width of the various perforations in sheet metal. In the process of making, the bars are laid in metal forms having grooves that are spaced exactly right, and then a soft metal in a molten state is made to flow in certain cross-grooves of the metal form. As the metal cools almost instantly, the wires are held at the exact right intervals. The smooth rounding edges of the bars afford less obstruction to the bees passing and repassing, and practical tests show that this form of excluder is superior to the old perforated metal.



Full size wire excluder.

Regarding the latter, unless the dies are very sharp there will be a slight rough burr edge on the under side of the sheet. It is impossible to remove this edge without reducing the width of the perforation. For this reason the wire excluder will doubtless supersede the other form of perforated zinc.

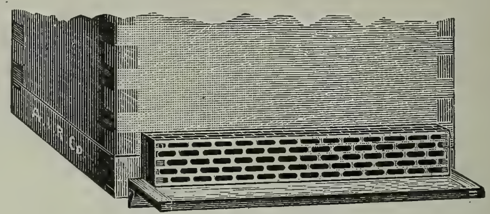
The illustrations herewith shown give one an idea of how the new excluder has been applied to drone-traps and honey-boards.

DRONE-EXCLUDING ENTRANCE-GUARDS.

If we put a strip of perforated zinc or wire excluder over the entrance, the worker-bees can go out, but the drones can not; but as a simple excluder is liable to get clogged if there are many drones in the hive, an arrangement known as the Alley trap is used.

* Invented by Frank G. Marbach, formerly of Medina, Ohio.

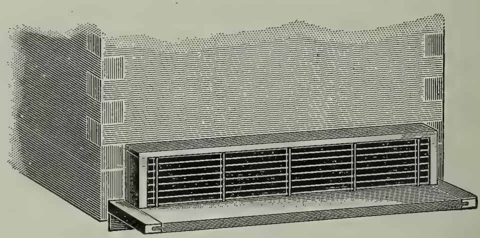
The plain guard is simply a strip of perforated metal, 3¾x14 inches long, folded at right angles, as shown. Each end is then



Zinc entrance guard.

closed with a block 1⅞x1⅞x½, fastened in place with a couple of double-pointed tacks. To use, place tight up against the entrance as represented in cut.

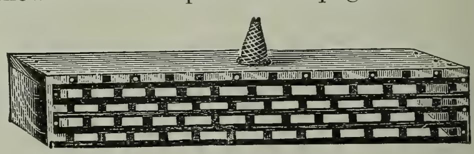
When it is desirable to get the drones *all* out of a hive without permitting any to get back again, we put the guard over the entrance and then shake all the bees in front of the hive. The workers will, of course, crawl back on the combs; but the drones will have to stay out, and the queen too, unless we watch for her, and put her into



Wire entrance guard.

the hive. In the morning, when the drones are stiffened with cold, they may be fed to the chickens or otherwise destroyed.

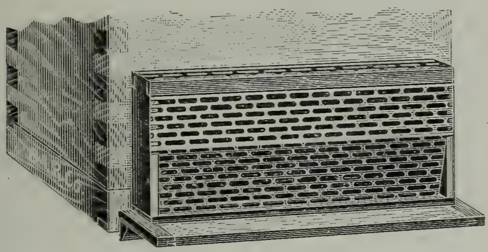
The drone-excluder just described is not automatic. Accordingly, the late Henry Alley, of Wenham, Mass., devised the one shown at the top of next page.



Alley's drone-excluder.

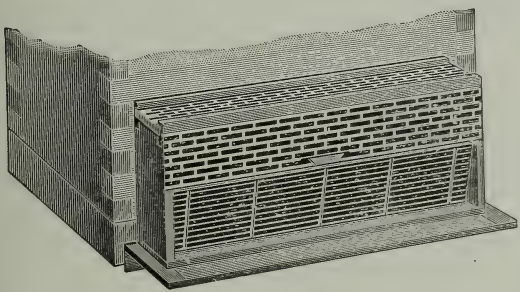
It is to be observed that this is similar to the one just described, only it has a wire-cloth cone in the top. The drones, after making a fruitless attempt to pass the metal, will enter the wire-cloth cone in the top, and escape; but none will have sense enough

to go back the way they came, but will huddle together outside and await their fate.



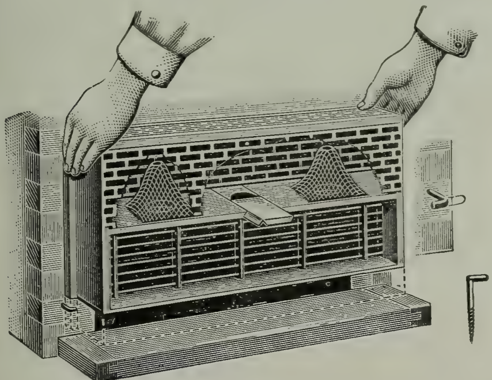
Perforated zinc Alley trap.

If it is desirable to get the drones into a box, so they may be carried to some other



Wire Alley trap.

apiary, for instance, a cage is made with an upper story, and a couple of these wire cones conduct the drones "up-stairs." If any worker-bees should go up too, they can



Manner of attaching Alley trap.

readily go up through the perforated zinc. This latter arrangement is shown in the cut above.

As to how this trap may be used for catching swarms, see SWARMING, elsewhere.

DYSENTERY.—When we see our bees covering the entrances to their hives with a yellow, brownish, or nearly black, disagreeable-smelling excrement or stain, we may say they have the dysentery, or what is usually known as such. If the weather becomes very warm and pleasant, they will usually get over it after they have had a full flight. If, on the contrary, the symptoms show themselves before warm weather, and no opportunity is given them to fly, they may get so bad as to cover their combs with it, and finally die in a damp filthy-looking mass.

CAUSE OF DYSENTERY.

The real cause is long-continued low temperature, further aggravated by bad food. In order to keep up sufficient animal heat the bees have to overeat, surcharging their intestines. The long-retained fecal matter results in purging or dysentery.* We can hardly think that any food alone would produce the disease, because we rarely, if ever, find the bees suffering from any thing they will gather, in warm summer weather. Honey gathered from rotten fruit, if we may call it honey, is very productive of this complaint, and cider from cider-mills is almost sure to kill bees at the approach of cold weather. We knew a lady who boiled up a mash of sweet apples and fed to the bees, because they were short of stores, and she could not afford to buy sugar for them. They all died of dysentery, long before spring. Where dampness accumulates from their breath, and settles on the combs, diluting the honey, it is very apt to cause these symptoms. Sorghum syrup has brought on a very aggravated form, and *burnt* candy or sugar is almost sure poison to bees during cold weather, although it may be fed them with impunity in the middle of the summer.

While it is very certain that no such symptoms are found in warm weather, it is also certain that a strong colony in a hive with soft, warm, dry porous walls, will stand an amount of bad food that a weak one, or one exposed to drafts of cold air, will not. We have known bees having considerable stores of cider, to winter very well if the colony were strong enough to keep the whole interior of the hive dry and warm. A powerful colony, if left with their hive uncovered during a rain storm, will soon dry themselves; and while they are doing this

* Normal fecal matter is solid, is passed in "formed" particles (of the shape of mouse excrement), which, if the hive is dry, soon dry, so they are fanned from the hive or are carried out. It is a "cold in the bowels" which causes dysentery, and it can easily be produced in midsummer if one proceeds rightly.—A. C. M.

they remind one of a sturdy cart-horse as he shakes the water off his hide and dries himself by his internal animal heat. While they have the health and numbers to repel moisture in this way, they are safe against almost anything. But to help them to keep this internal strength, they should have close and comfortable quarters, very much such as we would need for ourselves to enable us to pass a severe winter's night in health and comfort. The hives often used are so large and barn-like, in respect to the winter's brood-nest, that comfort is almost out of the question, for it does little if any good to pile straw, corn-fodder, etc., over the outside of the hives while the cluster within has no sort of protection at all. If they were in a hollow tree, the diameter of which was so small that they could fill it completely, they would be in much better place, especially if the sides were lined with soft dry rotten wood. We have seen icicles nearly as large as the arm, in box hives that were tight and large; these had all formed from the condensation of the breath of the bees. Now, should they melt during a thaw, in such a way that this water would run down on the bees and their unsealed stores, it would be very apt to produce unhealthiness, to say nothing further.

THE AGENCY OF THE APHIDES IN PRODUCING DYSENTERY.

The very worst winter food is, without doubt, the honey gathered from the aphides (see HONEY DEW); or, at least, most complaints have been made of this honey. As bees seldom touch this, except during drouths or unfavorable seasons, it no doubt has been the cause of much of the mischief. If the early honey is all extracted from the brood-combs, and the bees left with nothing but this bad honey, gathered in the summer, the matter is much worse; and many cases have been reported of colonies dying where the extractor has been used, while those untouched had been free from the disease. The moral is, refrain from extracting too closely from the brood-apartment. We would at least let the bees fill their brood-chamber with a good quality of honey, just before the yield ceases, extracting toward the close of the harvest, only from the combs in the upper story, unless we choose to feed them up for winter on sugar syrup or candy. We have had one or two favorable reports of wintering on the aphidian honey, from which we may conclude it is not always deleterious.

PREVENTION OF DYSENTERY.

From what we have said, one will probably infer that we would make the colony larger or the hive smaller, during the winter season. If we say, also, have the walls of the hive of some warm porous material that will absorb moisture and afterward dry out readily, he will have the idea so far. Perhaps the chaff cushions and division-boards are the readiest means at our command of accomplishing this. A dry cellar is excellent.

While bees might get along on almost any kind of food when thus prepared, we would by no means fail to give them good wholesome stores, as far as possible. Honey gathered in the middle of the season is generally wholesome; for by the time winter comes, it is thoroughly ripened by the same drying-out power we have spoken of. Honey gathered in the fall, if sealed up, is generally good; but some of the fall flowers produce a honey that seems to separate into a thin watery liquid, and a granular substance something like candied honey. We are not quite sure this causes dysentery, but it looks in some seasons very much as if it does. A syrup made of white or granulated sugar is always wholesome, and when bees are short of stores it is probably the cheapest and safest of any thing for feed.

We once wintered a colony on sugar stores, that came out so healthy in the spring that they did not even spot the white snow visibly, when they voided their excrement at their first flight in the spring.

A good many are asking if some other form of sweet will not give just as good results for feeding in winter. In reply we always say that a cheaper sugar has no more actual food value than granulated sugar, if as much.

CURE FOR DYSENTERY OUTDOORS.

If the affected colonies are outdoors, about the only real remedy is settled warm weather. Even one good warm day will often serve to alleviate the trouble, as it gives the bees a chance to void their excrement out in the open air, away from the hives and the combs. Otherwise the continued confinement during an extended cold spell sometimes compels the bees to retain

their fæces or excreta so long that they are finally forced to void it over the combs and over the hives. In such cases, where one has good nice clean combs of sealed honey he may take out the combs and replace with the clean ones. At the same time the brood-nest should be contracted down to a space the bees can fill. This work should never be done on a cool day—only when it is warm and balmy, as we have explained. But the practical beekeeper of to-day does not make it a rule to fuss with colonies affected with dysentery; for he knows that, as soon as warm weather comes on, the trouble will disappear of itself, in all such colonies as are not too far gone and too weak to recover.

Combs taken out of the hive in cold weather, and stained with dysentery, may be given to strong colonies in late spring or summer to clean up. Indeed, there is no danger in hiving swarms in hives where colonies have died with dysentery during the previous winter. They will quickly clean up and use the stores that are left.

DYSENTERY IN BEE-CELLARS.

After a long and cold winter, if the temperature in the cellar goes much below 40 degrees Fah., or if the stores are of poor quality, there is a liability of some colonies being affected with dysentery. The best remedy is prevention. The cellar should be dry, and the temperature should be as near 45 as possible. It should never go below 40 for a longer period than ten or twelve hours. If the temperature of the cellar can not be kept up, a small stove with a connection to a chimney should be used to keep the temperautre up to the requisite point.

Some authorities think that dampness has nothing to do with causing dysentery in the cellar; but dampness in combination with a temperature below 40 degrees for several weeks, we are satisfied, is the most potent cause of dysentery in cellar repositories. We have one cellar that is perfectly dry, and where we control the temperature. In this we have but very little dysentery—in fact, almost none. At our outyards we have damp cellars, and where, too, the temperature goes down below 40 degrees. It is a most noticeable fact that in these cellars we had so much dysentery we had to abandon them.

But what are we going to do if the bees do get dysentery? Suppose the food is bad, and the cellar one where it is not practicable to use artificial heat, say at an outyard.* If there are days during mid-winter when the bees can fly (and most localities do afford such weather for one day and possibly two), take the diseased colonies out on one such day and let them have a flight, then at night put them back in the cellar. A cleansing flight will do a world of good. We are well aware that some authorities disagree with us here; but our own experience has shown conclusively, over and over again, that it does pay. If the bees are suffering from an over-accumulation of poisonous fecal matter, why will there not be almost instantaneous relief as soon as it can be voided? It stands to reason that it should. If the food is bad, give the bees better next year. Some recommend taking away all fall stores and feeding sugar syrup. For further consideration of this subject, see WINTERING.

* Dry out the cellar with an abundance of calcium chloride.—A. C. M.

E

ENEMIES OF BEES.—King-birds and bee-martins, and a few other insectivorous birds, prey on bees. We once saw a single king-bird capture six or eight bees in as many trips, on the wing. It would alight on the peak of the barn near the apiary, and then make a dive through the air, grab one bee on the wing, return to its perch to dispose of its morsel, and then catch another.

There have been a number of conflicting reports as to whether king-birds do or do not swallow their victims. Some have asserted that they do, and afterward expelled the ball of bees. At one experiment station a number of king-birds were shot, and the conclusion, after examining their crops, was that they did not eat bees; but from observations that have been made since it appears that the king-bird does not generally swallow worker-bees. It grabs the bee, flies away, and, after it alights on some perch with its victim in its beak, bites away until it absorbs the honey or juices, when it drops the carcass, and flies away for another, which it treats in the same way. Observers have reported seeing these carcasses of bees below the birds' favorite perches.

The loss of a few bees which the birds might kill would amount to nothing; but in large queen-rearing yards, if the birds are allowed to go unmolested there is quite likely to be a loss of young queens; for no doubt the birds select the largest and noisiest-flying bees, and these, of course, will be *queens* and drones. If such be the case, the owner of a queen-rearing yard would do well to use his shotgun until every thing in the way of bee-killing birds is destroyed.

MICE.

Mice do harm only when they get into the hives, and this part of the subject will be sufficiently noticed under the head of ENTRANCES. It may be well to remark, that mice sometimes make sad havoc among surplus combs, when stored away with small patches of honey in them. The combs will be completely riddled during the winter time, if they are left where mice can get at them. On this account, the honey house should be mouse-proof; and for fear that a stray one may by accident get in, it is well to keep a trap ready, baited with toasted cheese. If you have not a tight room, make a tight box, large enough to hold all the surplus combs which have honey in them. See ENTRANCES.

PARASITES.

The only parasite we have ever seen is the *Braula coeca,* or Italian bee louse, and we have never seen them except on bees just imported from Italy.

The following from M. Lucien Iches, in "L'abeille domestique," Paris, 1905, quotes from J. Perez, *Notes d'apiculture,* and is about as authoritative as anything we have seen:

> One day, having captured a bee with one of these lice I fixed its head with a pair of pincers sufficiently to keep it unmovable, and to capture the small parasite easily. Both it and the bee were left for a while on the table in my studio, under a glass.
>
> When I returned to them I was not a little puzzled to see the parasite in the most vivacious and strange agitation. Seated on the fore part of the bee's head it was moving about with incredible vivacity, as though possessed of vertible rage. Now it would go to the margin of the bee's cap, with its fore feet raised, stamp and scratch as hard as its weakness would allow at the base of the bee's lip; then it would suddenly run back to the insertion of the antennæ to renew its impetuous attack immediately. I was quite taken up by my first surprise, when I suddenly saw all this fury turn to perfect calmness, and the little animal squatted on the edge of the cap and bent down its head to the bee's mouth, which was slightly trembling, and sucked up a drop of moisture.
>
> I instanly understood. The movements I had just witnessed were preparatory to the animal's meals. When the louse wishes to feed it goes to the bee's mouth, where the motions of its feet, armed with bent claws, produces a tickling sensation, perhaps disagreeable to its host, but at least provoking some movement of the bucal organs, which slightly open and release a small drop of honey which the louse at once licks up.
>
> Thus the *Braula coeca* is not a real parasite of the bee in the true sense of the word. It is rather a guest—queer, if you like thus to consider it, like so many others existing among animals.

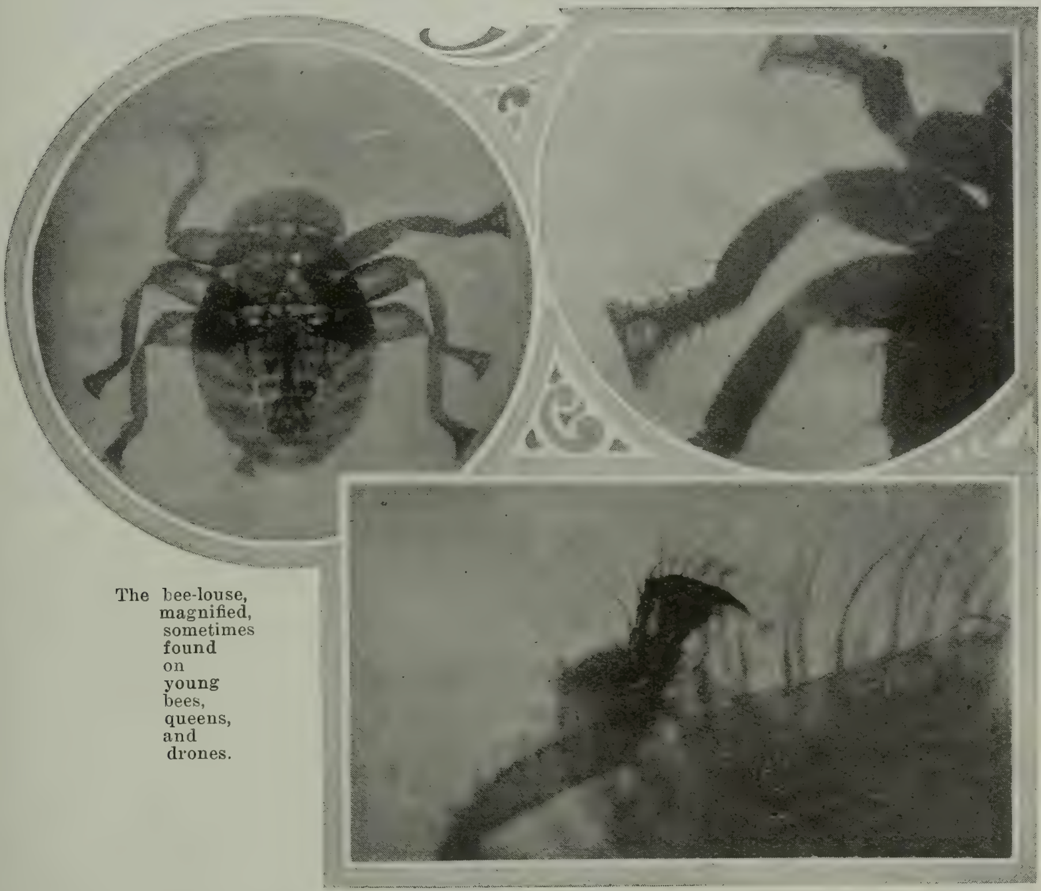
SKUNKS.

Skunks have been known to approach the hive at night time, and by scratching on or near the alighting-board, entice the bees out where they could "gobble them up." It would seem a little strange that these ani-

mals* have no fear of stings, but they, doubtless, are guided by a sort of instinct that enables them to divine how to get hold of the bee with its sweet morsel of honey in its honey-sack without being stung.†

SPIDERS.

Spiders as well as toads seem to have a rare appreciation of a heavily laden bee as it returns to the hive; we should therefore be careful that all spider-webs be faithfully kept brushed away from the hives, and that they have no corners or crevices about them



The bee-louse, magnified, sometimes found on young bees, queens, and drones.

to harbor such insects. Be sure there is no place which the broom will not clear out at one sweep; for where we have a hundred hives we can not well spend a great amount of time on each single one.

We are inclined to think that many of these so-called enemies take up the destruction of bees only as a chance habit, and that it is not always to be looked for nor expected. Common fowls sometimes get a habit of eating their own eggs; but it is so unusual an occurrence that we can hardly regard it as a matter of any very serious importance. It may be well at times to look out for the enemies that prey on bees; but, as a general thing, we think they are quite capable of fighting their own battles if we give them the proper care and suitable hives.

It was Mr. L. L. Langstroth, just before he died, who showed how spiders may be of value to the beekeeper. If, he said, they have access freely to the combs stored in stacked-up hives in the apiary, there never need be any fear that the moth-worm or moth-miller will be able to do any damage, for the spiders will shortly destroy them.

WASPS.

Wasps and hornets sometimes capture and carry off honeybees; but unless they

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* A lady correspondent in *Gleanings in Bee Culture*, page 866, Vol. XV., writes that she effectually got rid of skunks by the use of Rough on Rats stirred in an egg. This mixture was placed at the entrance of hives previously visited by skunks. After the doses had been repeated two evenings in succession the skunks never again paid their visitations.

† Some animals appear to be almost immune to bee stings. Some cats have been known to take a lot of stinging day after day without any apparent effect. Cattle and swine show little concern, and are seldom disturbed by bees.—A. C. M.

should take part in the work in great numbers, we would have no solicitude in regard to them.

MOSQUITO HAWKS.

A large fly, called the bee-hawk, or mosquito-hawk, has been mentioned by our Southern neighbors, but it is said to be easily frightened away by opening a vigorous warfare with whips and sticks.

Mosquito hawks, or "devil's darning-needles," as they are sometimes called, sometimes prove to be quite a nuisance when queen-rearing operations are going on in the South. They will catch the young queens when out on their mating flights, and destroy them. When the mosquito hawks come in droves, as they do, all queen-rearing operations have to come to a standstill, and there seems to be little or nothing that can be done to prevent or mitigate their "slaughter of the innocents." Fortunately, not many persons in the South are engaged in queen-rearing, and consequently the mischief these hawks do some seasons is confined to a very few.

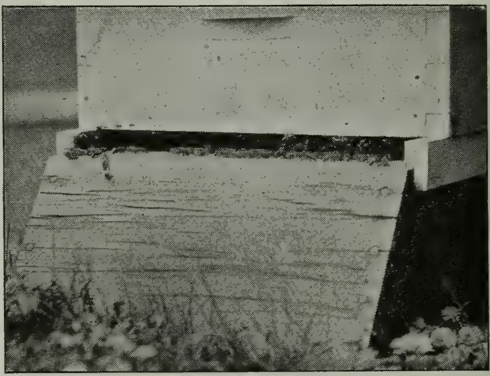
THIEVES.

Thieves are sometimes troublesome at out-yards, and once in a long while at the home yard. The best way to put a stop to their depredations is to put up a sign or two offering fifty or a hundred dollars reward for the arrest and conviction of the guilty parties. The thief is immediately warned that a price is upon his head, and that he had best, if he knows when he is well off, stop his stealing. It is seldom that the reward money is ever called for, and further annoyance is stopped.

ENTRANCE GUARDS.—See DRONES.

ENTRANCES TO HIVES.—We do not know that it makes any *great* difference to the bees, or with the amount of honey gathered, where the entrance is; whether at the very lowest part of the hive, or right in the top. We have had them do well with their entrance in almost all positions. On many accounts, an entrance even with, or a little below, the bottom-board of the hive would be most desirable. This gives the bees every facility for removing dirt or dead bees that frequently clog the hive and combs in cold weather; also bits of refuse comb, cappings from the cells, dust, etc., for this all falls to the bottom of the hive, and is naturally carried toward the entrance by the passage, out and in, of the inmates. There is another advantage in having it at the bottom of the hive. The warm air generated by the cluster, rising by its lightness, compared with the colder air outdoors, has a much less chance for escape than if the opening were nearer the top of the hive. If it is a little below the bottom-board, cold winds and storms are not so readily admitted.

An entrance part way up is not so liable to become clogged with dead bees; but, on the other hand, the live ones will not be able nearly so easily to remove the dead if they have to tug them up the perpendicular sides until they reach the opening; neither can the apiarist himself assist in the pro-

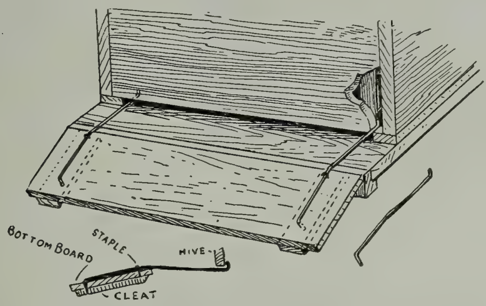


cess. Where the entrance is on a level with the bottom of the hive, he can reach in with a hooked wire and rake out all the dead bees that may have accumulated during the winter. Indeed, he should, if the accumulation is enough to clog the entrance, clear it out once or twice during the winter, with a wire.

There is still another objection to a high entrance. During cool weather many of the flying bees on returning will become chilled in their efforts to crawl up the perpendicular side, and thus fail to get into the hive; so, all things considered, an entrance that is handy for the bees is also best for the beekeeper.

On account of the tendency of returning bees to chill in cool weather, there should be a large alighting-board if the hive is raised off the ground; or if on the ground, there should be a nice easy slanting grade or door-step to the entrance. All grass and weeds should be kept down within at least a foot of the front of the hive; and it would be better if there were a full yard of clear space. Bees that come in heavily laden are

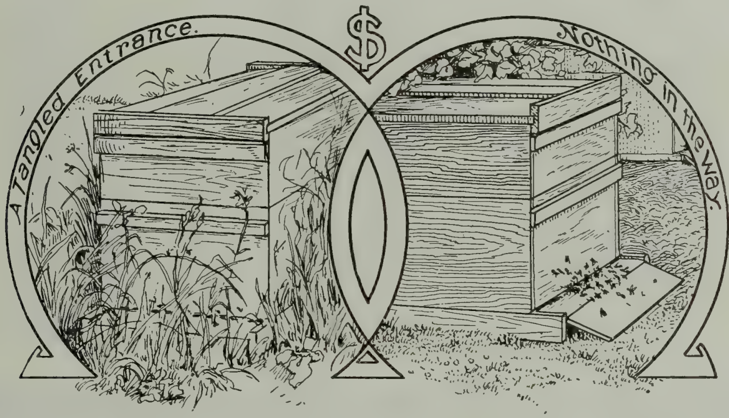
often knocked down by bumping into tall weeds or sprigs of grass. While they ultimately take wing, making another attempt, and finally land in the hive, such obstructions, if hindering to the bees, cause a loss to their owner.



It is impossible to estimate just how much the loss in honey is; but if the actual figures could be secured the producer would be surprised. When it is such an easy matter to cut away the weeds, or keep them away from the entrance with a little sprinkling of salt or with a wide board, it is "penny wise and pound foolish" to wear out the wings of our little servants trying to pass this obstruction, at the same time delaying them when every moment counts. Farmer beekeepers especially seem to have the idea that bees will work for nothing and board themselves, and in three cases out of five one will find the entrances of their hives, what few they may have, all tangled up with grass and weeds. On mornings when there is a heavy dew such obstruction is very considerable.

Very many use a scythe, lawn-mower, or a common sickle, to cut down the grass. Others keep it down with a small handful of salt scattered around the front of the hive. Still others prefer to use a piece of board about a foot wide or more, and as long as the hive is wide. Rough unplaned lumber of the cheapest kind is better than clear planed stuff, as the bees can cling to it better. The boards should be cleated and laid directly on the ground, abutting up close to the bottom-board if it rests on or close to the ground. No grass or weed can grow, of course, where these boards are laid; and general practice shows it is cheaper and better to use such boards than to be compelled to use salt or cut down the obstructions every few weeks in front of the hive.

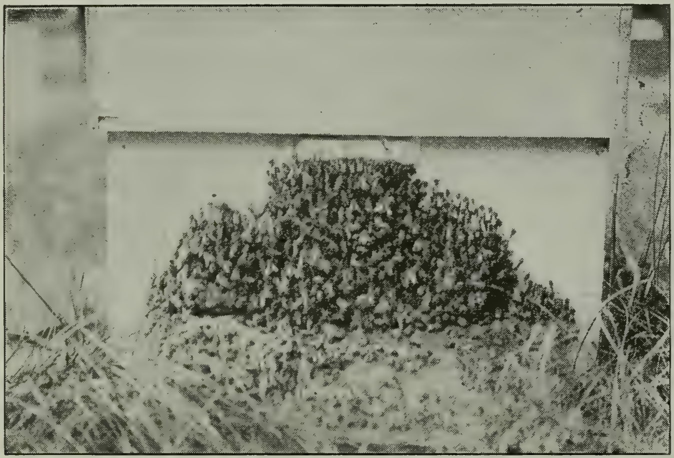
One of the drawings contains a suggestion which can be very easily applied to the cleated boards just described. Bend some iron wires, about No. 8, as shown with hook at each end. Drive one of the hooks into the board as here illustrated, and secure in position by means of a common blind-staple near the other edge. If the wires are cut right, this alighting-board can be easily hooked into the entrance and make a nice easy grade from the ground up to the hive. At any time these alighting-boards can be unhooked so that the grass can be cut down with a lawn-mower and then replaced.



SIZE OF ENTRANCES.

This depends on the season of the year, the size of the colony, and whether the bees are wintered indoors or out. During the height of the honey-flow the aperture should be as large as the bottom-board or hive will permit—not less than ⅞ inch deep by the width of the hive. Experience has shown

Hive raised on four blocks to provide ventilation and to some extent keep down swarming.



A colony with an entrance too small where the bees have formed the loafing habit.

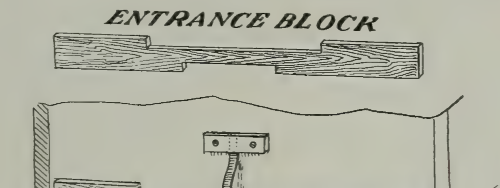
Bees actually suffering for want of ventilation.

that a contracted opening does not give the bees sufficient ventilation; and the result is, the great mass of bees are forced out of the hive, where they will loaf day after day, doing nothing. When they once get into the loafing habit they will be much inclined to swarm, to say nothing about wasting valuable time during that part of the season when, if ever, they should bring in money in return for all the labor expended on them.

Where one uses hives of the loose-bottom type, he can usually cure this clustering out and loafing by raising the brood-chamber off the bottom, placing four blocks ⅞ of an inch thick on the bottom-board and setting the brood-chamber back again. This will provide an opening on all four sides. While the bees will use the front or main entrance mainly, they will fly out from the others. With so much ventilation the bees, unless the colonies are extraordinarily strong, will go back into the hive and go to work. Some beekeepers go so far as to claim that the procedure will almost entirely eliminate swarming. For further particulars on this subject see "Prevention of Swarming" under head of "Swarming." See also the illustrations on the previous page.

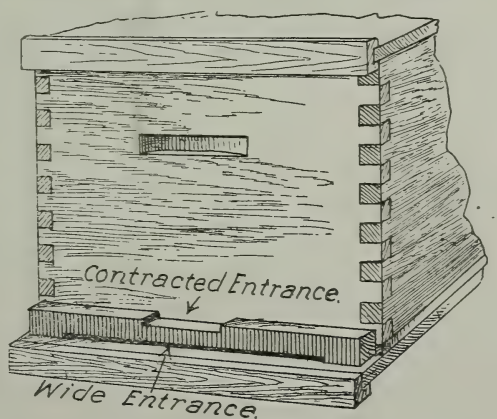
Nuclei or weak colonies must have no larger entrances than they can easily defend. They should be as small as possible after the regular honey-flow, for then it is that robbers are liable to rush in pell-mell and overpower the guards of the little colony, depriving it of the scanty store it may have. See ROBBING. A two-frame nucleus should not have an opening larger than will admit two or three bees at a time if it is during the robbing season. When the honey-flow is on, it may be larger; but it should be contracted as soon as it eases up.

When cool weather comes on the entrances of all colonies should be contracted, both strong and weak, and kept so during the entire winter if bees are left outdoors. Formerly the practice was to allow the full size; but experience has shown in many localities that this is a serious mistake. There is no more reason why the bees should have their doors wide open in mid-winter, letting chilling drafts blow in, than that we should leave our doors open. An ordinary eight-frame Langstroth hive should have an entrance not much larger than 8 inches wide by ¼ deep. During very severe weather it might be still further closed. Some of the very strongest colonies may have an opening of 8 or 10 inches; but with this contracted entrance it may be necessary for the apiarist to hook the dead bees out with



a wire two or three times during the winter, and possibly once in the spring; for in no case must the opening be clogged up.

It is customary to have some sort of cleat to reduce a wide entrance to a small slot

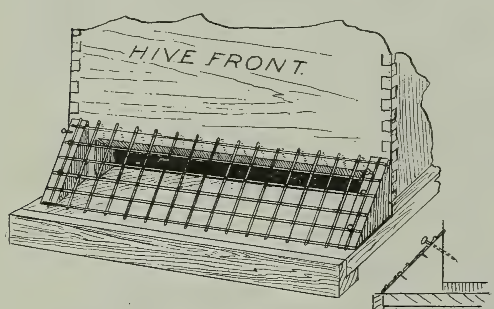


on one side ¼ by 5 or 6 inches. This, when inserted slot side down, reduces the opening to the proper size for outdoor-wintered bees. In cleaning out the dead bees the entrance-stop should be removed entirely,

making the entrance itself the full size. Any dead ones that may have accumulated should be raked out and the stop put back. If it is discovered that the colony is weak, the slot should be reduced to one inch in width. At the same time the frames should be contracted to the number that the bees can reasonably occupy or cover. If they are compelled to keep a large room warm, much above their present needs, they may die from cold.

The illustrations show very simple cleats which can be made at any planing-mill, or can be cut at home, using nothing but a common hand-saw and a chisel. These cleats give various-sized entrances according to the way they are attached. When the cleats are removed entirely the full opening of the hive is provided.

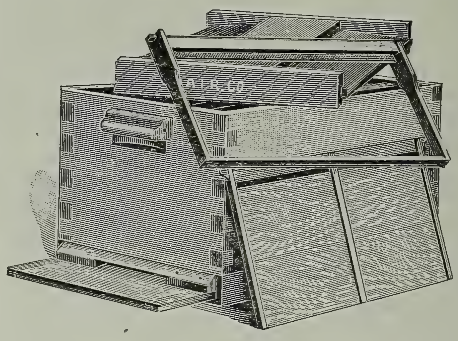
If a cool or cold spell suddenly comes on in the spring after a stretch of warm weather, during which the bees have a large amount of young brood started, some of the brood is liable to be lost unless the entrance is contracted or closed temporarily.



Coarse wire mesh that will let bees through but exclude mice.

Under the heading Enemies of Bees we referred to the depredations of mice during the winter. It often becomes necessary to screen the entrances of hives put in the cellar or out on their summer stands if wintered outdoors. Mr. W. D. Keyes, of Wilkinsburg, Pa., uses a very simple device, consisting of two triangular blocks and a strip of coarse-mesh cloth, just coarse enough to let bees through it and yet exclude the mice. It is very quickly applied; and if there is one to each hive in the apiary it will make very little expense, especially when we remember that a mouse on even one frame of young brood may do enough mischief in a single colony to pay the whole expense of these excluders for the whole apiary.

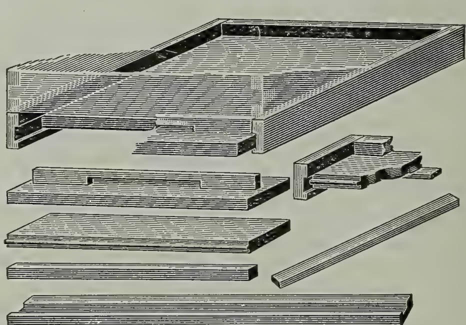
The accompanying illustrations will show the modern Dovetailed and Danzenbaker



Entrances properly contracted for winter.

alighting-boards having cleats nailed on them permanently. When the board is pulled out entirely it gives an entrance $1\frac{1}{4}$ inches deep by the width of the hive. When the plain side is inserted, the entrance is reduced to 8 by $\frac{1}{4}$ inch; and this may be further reduced, if necessity requires it, by putting in a $\frac{1}{4}$-inch strip of wood of sufficient length to bring the entrance down to the point required.

While it is true that a plurality of entrances may be a detriment in a brood-chamber, it does not necessarily hold good during the honey season when the hive is tiered up two or three stories high. It then becomes difficult, and wasteful of bee energy



Detachable alighting-board and how it may be used to vary the size of the entrance.

that might be better employed, to ventilate the whole hive from one entrance, however large it is in the lower story, for the bees have to maintain a current of air rushing in, and another going out at the same aperture. If queen-excluders are used the case is made worse. It almost goes without say-

ing, that, during the period in which the honey is evaporated while in the combs, there ought to be more than one entrance to the hive—at least two, and, during very hot weather, more, one to each story, with the cover or roof slightly raised at the back to furnish additional means for the fetid air to escape at the top of the hive.

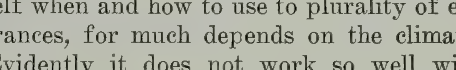
It is said by those who have tried this method of air control that it is a great preventive of swarming, and it looks reasonable; for the brood-chamber is far less crowded, since the field workers arrive and depart from the upper entrance to a great extent, saving over-crowding of the brood-chamber, which surely leads to swarming. On the other hand, it may be said that there is danger of the honey-chambers being rendered too cool by so many entrances; but against this may be stated that, if this is the case, it is also too cool for honey-gathering, and the upper stories should be removed. If the colony is weak, upper entrances are unnecessary; and in that case, also, the honey-chambers should be removed, as such a colony does not gather a surplus in any event. It is too weak.

Some of our well-known writers on bee culture heartily recommend upper entrances —notably so Dr. C. C. Miller, C. P. Dadant, R. F. Holtermann, and, in early times, Adam Grimm, who, with the money he made with his bees, established a bank.

Dr. C. C. Miller, writing in *Gleanings in Bee Culture* for June 1, 1907, writes: "Prof. Cook says, p. 312, that bees ventilate so effectively at the entrance that it is best to have only one opening to the hive, evidently meaning at all times; and W. K. Morrison, page 686, asks if I subscribe to that doctrine. Emphatically, no. If running for extracted honey I would generally have one more opening than the number of stories in use—the regular entrance and an opening at the top of each story. Each year for years I have had one or more piles thus ventilated, and none has ever swarmed. Many years ago I learned from Adam Grimm to have an opening for ventilation at the top of the brood-chamber at the back end when running for comb honey. I gave it up because it interfered with the finishing of the sections near such openings. But I have gone back to it again, believing that such disadvantage is overbalanced by the gain in ventilation. You can't make me believe that it is not easier for the bees to have one hole for the air to go out and another for it to come in than to make the air go both ways in the same hole."* The practical beekeeper will soon discover for himself when and how to use to plurality of entrances, for much depends on the climate. Evidently it does not work so well with comb-honey production as it does extracted; yet even this may be satisfactorily arranged. It looks now as if plural entrances were a long step toward swarm prevention by causing the field workers to leave the brood and confine their energies to storing honey in the upper chambers. See SWARMING.

ENTRANCES FOR INDOOR WINTERING.

Authorities differ as to the size of entrance that should be used for indoor wintering. Some argue that, the larger the openings, the better. A few go even so far as to urge that the bottom-boards be removed entirely, one hive piled upon two



others, leaving an opening between the two lower hives of about one-third of the size of the entire bottom of the hive. Others advise a regular bottom-board, but an entrance two inches deep by the full width of the hive; while others recommend no larger entrance than the bees have during the summer.

The preponderance of evidence seems to be in favor of the last-mentioned size. Too much ventilation, even in a cellar where the temperature is reasonably under control, has a tendency to induce too large a consumption of stores. Over-feeding causes dysentery; and when that happens in a bee-cellar the colony is doomed unless it can be given a flight on a warm day, as recommended under the head of WINTERING in the latter part of this work.

Our practice has been to use the same entrance that we have in the summer for our indoor-wintered hives; and so long as we used that size we had excellent results in wintering. But one winter, for the purpose of experiment, we raised each individual

* Put a fluffy feather just before and behind a fanning bee, and see where the draft is. Bees "draw" the air out of the hive, and the fresh air filters gently in, where it may—an ideal way of avoiding cold drafts on the brood.—A. C. M.

hive off its bottom-board and inserted a rim three inches deep and of the same outside dimensions as the hive. The sides of these rims were open, but covered with wire cloth. The result was that we lost over 100 colonies out of the 230 odd put into the cellar, and the rest came out in a very weakened condition.

The bee is essentially a warm-blooded animal. Experience has shown that a temperature of 45 degrees Fahrenheit in a cellar gives the best results. An ordinary colony with ordinary summer entrance in such cellar temperature will be able to warm the interior of its hive without too much expenditure of animal heat. When the bees are too cold they will eat largely of their stores, and in doing so bring on disease.

EUCALYPTUS.—While there are something like two hundred species of eucalypti recognized in Australia by scientific botanists, some thirty species of this tree have been introduced into California from that country, a few of which are now being planted quite extensively for commercial purposes. The majority are so limited in distribution that their value as honey producers are as yet undetermined, though all are said to yield nectar.

The blooming period of the various species cover every month of the year.

Those the most common at the present time, as well as those being most extensively planted, do not yield honey of a commercial value, being of a decided amber, with rather a bitter acid flavor, though a few species are said to yield an excellent honey.

Blue Gum (*Eucalyptus Globulus*) is perhaps the most extensively planted of any. The blooming period of this, as well as Swamp Mahogany Gum (*Eu Robusta*) which is also quite largely planted, comes during the winter months when their value as a breeding stimulant in some localities can harly be overestimated, though this seems to be the chief value of these wonderful producers.

A number of other species are well worth consideration, but the blooming period of the others that are planted to any extent comes for the most part at a time of the year when their value is much less.

There are a few species that are said to yield an exceptional nectar. Quoting from Honey Plants of California, "White Ironbark (*Eu leucoxylon*) reported to be a great honey producer with a beautiful flavor, much like vanilla extract." Quoting again, "(*Eu. placeafolia*) rare, a wonderful producer of a water-white honey, and according to Mr. M. H. Mendleson, of Ventura, Cal., as many as three bees at one time have been observed to sip up from a single blossom as much nectar as it was possible for them to carry off."

EXTRACTED HONEY.—This is a general term that applies to all honey that has been removed from the comb by means of a centrifugal machine known as a honey extractor—hence the name, "extracted honey." Not all liquid honeys are extracted, because sometimes honey is removed by crushing the combs in a press. But this method, besides destroying the comb, was so very crude that it has practically gone out of practice except in some very limited areas in Europe. There are a few honeys, it is said, that are so very thick that they can not be readily removed from a comb by an extractor by centrifugal force. Among them may be mentioned the far-famed heather honey of Scotland. Practically all honeys, however, can be extracted with a machine, providing the rooms in which the combs are stored are brought to a temperature of 70 or 80 degrees Fahrenheit, and maintained there for 24 hours before extracting begins.

There are two classes of extracted honey. One is suitable for table use, and the other for manufacturing purposes. The first named comprises the light-colored honeys, such as the clovers, basswood, alfalfa, and sage, usually of fine body and flavor, and suitable for eating with bread and butter and biscuits, or even as a clear syrup. Honeys for manufacturing purposes comprise mainly those that are used by extensive bakeries of the country who find that honey has not only the peculiar quality of making their sweetened cakes keep soft and moist for months but imparting a honey flavor. It therefore comes to pass that hundreds—yes, thousands—of carloads of rich dark honeys are used by the National Biscuit Co. and other large baking concerns, for no artificial product that has ever been produced seems to take the place of honey. Some cakes, like honey-jumbles, contain a larger percentage of honey than others.

Many other cakes and cookies contain some honey along with molasses and the cheaper syrups. See HONEY AS A FOOD.

Under the head of EXTRACTING we explain the process of throwing honey out by centrifugal force without destroying the comb. Under BOTTLING HONEY we describe the art of putting the product up for market in glass. Under COMB HONEY we discuss the relative eating qualities of comb and extracted honey. In this article we shall concern ourselves more particularly with the problems of how to produce a fine article, retaining as much as possible the flavor of the product while in the combs; for it is not possible, we maintain, to produce any extracted that will have *all* the delicate aroma that it possessed before removing from its original containers; but for the purpose of most consumers a good quality of extracted will be fully the equal of our best comb honey. A good many producers, in their eagerness to secure *quantity*, sacrifice quality; for be it said that honey which has been allowed to stay on the hives for some little time after it is sealed acquires a body and a richness of flavor that a honey just sealed does not quite have. No honey should ever be taken from the comb unless it is *entirely* capped over. There are some producers who claim they can save all the trouble of uncapping (see UNCAPPING under the head of EXTRACTING, by extracting the honey before it is sealed over by the bees. There is no question that *more* honey can be secured in this way, but it is equally certain that the product will be inferior to that which has been left in the hives long enough for the bees to seal over thoroughly and ripen, which they will do if given an opportunity.

In 1870 we extracted from our apiary of less than 50 colonies, over 3 tons of honey. It was put up in 1-lb. bottles, and more than half was sold for 25c per pound when prices were high on extracted honey. During the fore part of the season the honey was allowed to get pretty well capped over; but during basswood bloom, we, bees and all, got somewhat crazy, we fear, and they brought in what was but little better than sweetened water; we extracted and put it into bottles, and hurried it off to fill orders, hoping it would all get "good" as soon as the weather got cool. It candied when the weather became cold, for almost all honey will candy, or at least one portion will candy, leaving a thin watery part, which, if it does not sour, acquires in time a disagreeable brackish flavor, like that acquired by liquids standing in an old barrel. At about this stage it shows that peculiar quality of pushing the bungs out of the barrels, and the corks out of the bottles, running over on the shelves and tables to the discomfiture and disgust of everybody who likes to be cleanly in his habits. When we tasted some of the honey in one of these bottles, six months afterward, we did not wonder it had stopped selling, and we made up our mind it should no more be offered for sale. We believe it was all poured out of the bottles, and sold to a tobacconist. The contents of the jars were not all alike, for the thin watery honey has quite a tendency to swim on top. We, one season, commenced to retail from a barrel of what all pronounced fine clover honey. One day a customer returned some, saying it was not like what he bought before. We assured him it was drawn from the same barrel, and went and drew some, to convince him. Behold! it was sweetened water, compared with the first. The thin honey having risen to the top, it was the last to be drawn off.

Again, new honey has, many times, a rank, disagreable odor and taste. We have been told that in the Eastern States much honey is sometimes obtained from the fields where onion seeds are raised for the market, and that this honey, when first gathered, is so strong of onions that it can not be used. In a few weeks, however, this rank and disagreeable flavor has all gone, and the honey is very fair.* Few persons can tolerate the strong, aromatic flavor of basswood honey when first gathered, and some of the jars we have mentioned, when opened, gave one the impression that something akin to turpentine had been mixed with the honey. This was because it had been closely corked when first gathered; had it been left in the comb until sealed, the unpleasant taste would have mostly disappeared. We say mostly, for even sealing does not seem to remove entirely the rank flavor, until the combs have been some weeks in the hive. We remember we once took a beautiful-looking piece of comb honey out of a jar that was found in the market. On opening the cells

* But never free from the flavor of onions. It is much prized by some druggists for use in making cough syrups.—A. C. M.

we found the honey had such a rank basswood flavor that it was, to us, quite disagreeable, and yet we are fond of the basswood honey. Very white new comb honey is seldom of the fine, pure, sweet flavor of honey that has been a long time capped over, such as is found in the dark-looking comb. To which shall we give the preference—looks or taste? We once were so busy that we could not attend to extracting, and so we raised the filled stories up, and put some filled with empty combs just under them over the brood. This occupied little time, and the bees were not hindered in their work a single moment. We have never seen bees amass stores faster. Some colonies filled four stories to repletion, and the whole was left on the hives until the latter part of the summer. In fact, we left them on so long to be safe fom the depredations of the moth, intending to cut out the honey and sell it in the comb, or to extract it, whichever form should prove most marketable. This honey was cut out of the frames and sold the following winter; and it was the nicest and richest honey we ever saw or tasted. To our astonishment, the liquid portions, that ran out when the combs were cut, would not candy at all, even when exposed to zero weather. The honey was so thick that a saucer full could be turned over without spilling.

Extracted honey, if taken out while "green" (as we have often termed the unripened state), has a greenish tinge, which well-ripened honey has not.* Some specimens have a turbid or cloudy look, and we believe such honey is never really fine-flavored. We are well aware that we are condemning the very honey we once sold, by these remarks, but we can not help it. If we had now some extracted honey such as was taken from those well-ripened combs, we would feel that it was preferable, at 12 cts., to that which sells at 5 or 6 cts. Properly ripened basswood or clover honey has a sparkling clearness, of a slightly yellowish tint, and the flavor is pure and exquisite. We have never seen any nice-looking comb honey equal to it, for the market always demands comb honey that is white, and has not remained on the hive a long time. We do not mean to say that extracted honey should be without color, like water, for it usually has a transparent pale yellow tint, or it may be quite yellow. After it has candied, if it does candy, it should be hard, and free from any liquid portion, like that in unripened honey. This thin liquid portion is the part that usually changes and gives it the bad taste. In fact, if the liquid portion be drained off, the solid portion may be melted, and it will be found very nearly like that ripened in the hive.

* Pure sweet clover and cleome are exceptions.

RIPENING HONEY BY ARTIFICIAL MEANS.

The most that is done in the way of evaporating honey that is not entirely ripe is to put it in large tanks, covering the top with a semi-porous cloth tightly tied down over the edge of the can to prevent robber bees from getting in. In California these tanks hold anywhere from 20 to 30 tons. In some cases the tanks are contracted toward the top, leaving an opening of about 18x24 inches. In other cases the tank has a large diameter of about eight feet, and only four feet high. This presents a large surface of honey, and the evaporation, therefore, would go on more rapidly. These great honey-reservoirs are usually set down outdoors, and covered as before explained. As it seldom or never rains in California during the dry season the honey, it is said, will evaporate down to a good thick body, even if it is not entirely ripe when taken out.

The late E. W. Alexander, of Delanson, N. Y., used oblong tanks in small buildings painted a dark color to draw the sun's rays. In these he stored his partially ripened buckwheat until it thickened up.

Whether such evaporated honey is equal to that which has been ripened entirely in the hives, we have our doubts. We have sampled both kinds, not knowing which was which, and we believe that in every case we have been able to tell the natural from the evaporated article. Commission men and producers strongly urge that no honey be extracted except that which has been capped over. A few experts may practice artificial ripening, but the average beekeeper should leave that wholly to the bees.

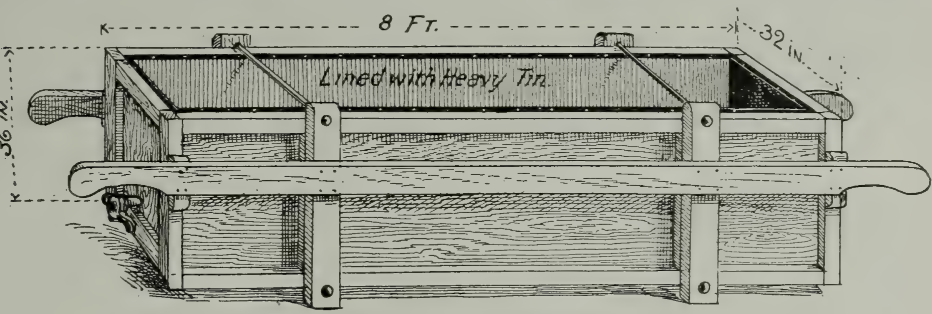
HOW TO KEEP EXTRACTED HONEY.

Unless the crop has been secured early it is best to dispose of it at once, when the market is at the highest; but it is sometimes advisable to hold the honey until the price again goes up, which it is likely to do after the berry season is over, when every one is

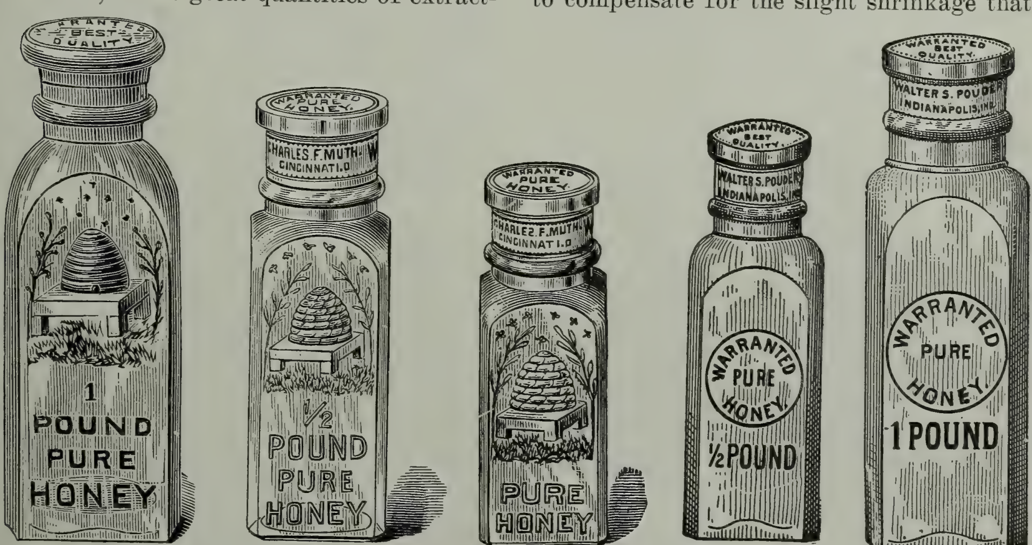
thinking of the holidays, Christmas and New Year's; for it is then that honey comes into fresh demand again, and the market becomes firmer.

Extracted or comb honey either, for that matter, should be kept in a room about as near summer temperature as possible. The mercury ought not to drop below 70, and it may go as much higher as ordinary summer weather will permit—even 90 or 100 in the shade. Extracted, if kept, should be stored in big tin cans, or better still, in a large tank, one capable or holding eight to ten barrels, if the apiarist is so extensively engaged in beekeeping that he is likely to have that amount of honey on hand at one time. Where the cans hold more than 500 lbs., it is customary to have them made of galavanized iron; and while some objection has been made to this metal because of its alleged poisonous quality, yet in the large-sized cans no injury to the honey has ever been noted; for it is the custom in California, Arizona, Colorado, and other States of the West, where great quantities of extracted honey are produced, to have the honey stored in large galvanized storage-tanks, some of them practically good-sized cisterns above ground. In those hot climates the honey will remain liquid for some time, and can be kept perfectly clear until cool weather comes on. If the honey has a tendency to granulate very soon after extracting, it would not be advisable to have it stored for any great length of time in these large tanks. It should be drawn off into the marketing tin pails we have described under GRANULATED HONEY, and allowed to candy hard. It may be kept in this condition for a year or two, without detriment: and whenever it is used it may be liquefied by the directions that go with the package.

Ordinarily we would not advise the storage of honey for any considerable time in barrels; but when no other storage room is admissible, barrels may be used, but they should be watched to see that they do not start to leak in the honey-room; and occasionally the hoops should be driven down to compensate for the slight shrinkage that



One of Alexander's storage and evaporating tanks for extracted honey.



Several styles of glass packages for selling and shipping honey.

may take place; for it is a fact that the staves of barrels, even when filled with honey, will shrink somewhat in dry hot rooms, with the result that there will be a leakage, and probably robbing on the part of the bees. If honey be stored in barrels they should be waxed on the inside as described under BARRELS. The bungs should be left out, and the barrels be kept in a hot dry room. When ready to ship, the bungs should be driven in, and hoops driven tight.

NO ADULTERATED EXTRACTED HONEY.

Some years ago a large part of the so-called extracted honey in the market was adulterated; but of late years, owing to the enactment and enforcement of the national pure-food law, the adulterated product has been almost entirely eliminated from the market. One may be almost absolutely certain that any liquid honey that he buys in tin, glass, or wood, will be the pure product of the hive. Some of it may be of very poor quality, but that does not signify that it is adulterated. Some honeys are not fit for table use, and some others are used for manufacturing purposes. See ADULTERATED HONEY for a further discussion of this question.

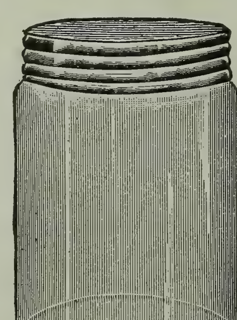
VARIOUS PACKAGES FOR SHIPPING AND SELLING EXTRACTED HONEY.

The variety, style, and kind of packages that have been used in putting up extracted honey for retail purposes are almost unlimited. It is the usual rule that, for any thing less than 3 lbs. capacity, glass should be used; for any thing larger, tin cans or pails. Perhaps the most popular glass package is the Mason jar, already mentioned. They are popular because they can be bought at any grocery, and no one objects to buying them with the honey, since they are always a useful article in domestic economy.

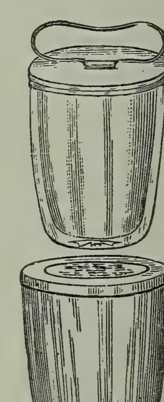
Other packages used largely are the Muth and Pouder bottles that are made especially for holding honey. Molded right into the glass itself is the image of an old straw beehive and the words "Pure Honey." These bottles are square in shape, and very nice for shipping and for retailing small quantities. The smallest size is especially adapted for holding a dime's worth of honey, and, all in all, it is a very pretty size.

Another package much used is the jelly-tumbler, and this, like the Mason jar, has the advantage that it is useful in the house.

With each one there is usually a little circular piece of paraffined paper. After the tumbler is filled with honey this paper is placed on top, after which the tin cap is crowded down over the whole, making an almost hermetical sealing.



No. 25 jar

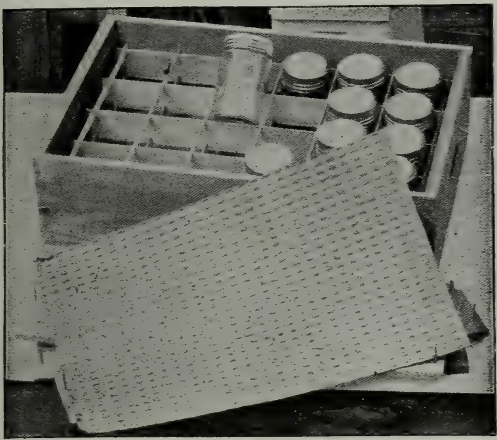


Jelly-tumbler

Another favorite package, especially for display purposes, is what is known as the No. 25 jar. It is self-sealing, somewhat on the order of the Mason can. It is handsome in appearance and cheap in price. These are used very largely.

Still another style of jar with a quick-fastening top is known to the trade as the Tiptop, as shown in the acompanying illustration. In putting up honey in glass it is

important to have a variety of packages, as this helps to make a display of honey in



How the No. 25 jar is packed.

grocery windows. In all cases it is desirable to use a jar that can be used for something else when empty. For that reason the Mason jars, jelly-tumblers, and all self-

sealing packages, have the advantage over others using only corks, which may be lost.

The styles of jars shown above were introduced in 1908 and 1909. When a combination of these different styles is used on shelving, for exhibition purposes, they help to set off the honey in a general display. See Exhibits elsewhere.

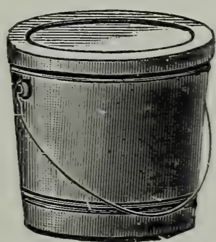
But one who does a large business in putting up honey in glass should not confine himself strictly to one size or kind of package. For purposes of display at groceries he should have an assortment of Muth bottles, Mason jars, jelly-tumblers, and some

Williams' stand for selling extracted honey.

of the No. 25. An assortment of these can be very tastily arranged in the grocery show window. Sometimes a little honey-stand may be used to advantage. The one shown above is the one that was used by George F. Williams, of New Philadelphia, Ohio. So much for glass packages. See Honey, Peddling.

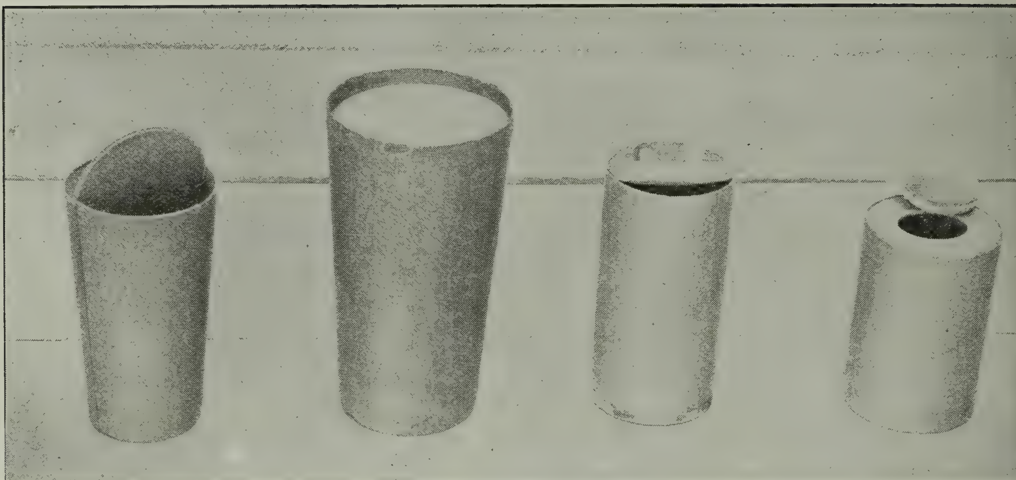
TIN PACKAGES FOR HONEY.

While tin cans holding ¼, ½, 1, or up to 5 lbs., have been used for holding honey they are not nearly as desirable as glass. Crystal-white honey itself is beautiful; and to



Sloping-side pail.

conceal it from sight by tin and a fancy label is a mistake. The purchaser of a small quantity requires to see what he is buying; and when the tin package and the glass package of equal size are put side by side on the counter, it is quite generally admitted that tin should not be used for quantities less than 5 lbs., to say the least. Above this size lard-pails and nested pails are used.



Forms of paper milk-bottles that might be used for honey.

The former have sloping sides and can be nested together in so small a compass that 100 7½-lb. size can be put in a barrel; but such pails are not adapted to shipping extracted honey unless it is candied. See GRANULATED HONEY. They do very well for retailing around home and at local groceries. Nested pails answer a similar purpose.

The smallest one holds a pint, and the largest four quarts. One reason, perhaps,

A nest of five raised-cover pails.

why these pails are sold for the purpose in such enormous quantities is, that they are of just such sizes as to be extremely convenient for household purposes. The pails shown above are short, so as to be handy for a little girl's or boy's dinner pail, or other like purposes. Such a pail does not give the greatest economy of tin, however, nor is it suited for a graduated measure like those next shown.

The next cut explains the great point in favor of graduated pails; that is, they will measure accurately any liquid, going down to as small a quantity as half a pint, and as large a quantity as a gallon, where one has a complete nest. Of course, suitable labels are to be used on these pails when they are full of honey; and, furthermore, none of these pails can be turned upside down without leakage, unless, indeed, the honey is candied so that it will not run in cold weather, as is often the case with a well-ripened article. They are used principally by retailers who purchase their honey by

Graduated tin pails.

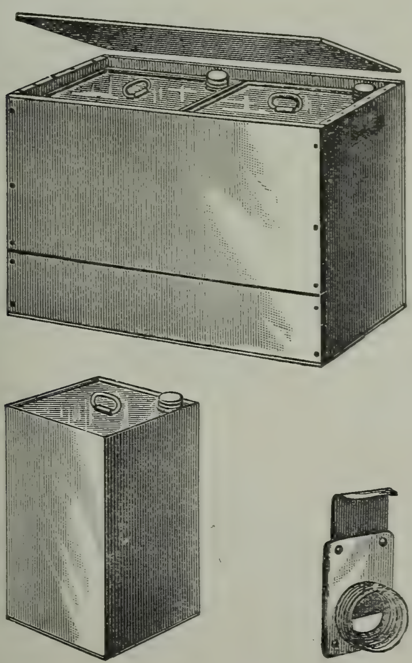
the barrel, and put it into pails about as fast as their customers want it. They are to be carried about, however, rather than to be shipped long distances.

The packages thus far shown for holding or retailing honey are made of glass or tin. In most cases when the honey is emptied out of them they are useful for some other purpose. The Mason jars, or any of the screw-top cans, can be used for the preserving of fruit, the honey-tumblers for jelly, and the pails for general culinary purposes around the home. But sometimes the good housewife has too large a supply of these very articles in the house, and does not care to buy any more packages which she can not use. For this class of trade we know of nothing better than the different forms of paper milk-bottles, which, during recent years, have been put on the market.

They are self-sealing, and, if tight enough to hold milk, ought to be good enough to hold honey.

They are very cheap, for a box of them containing two dozen bottles or packages can be purchased for the insignificant price of 25 cents. A quart of honey, or a pint, could be sold in such packages very cheaply, and if the purchaser objects to the more expensive glass and tin containers, furnish these.

For large quantities of from 200 to 500 lbs., kegs and barrels may be used. All such should be perfectly tight and *bone dry;* and to prevent the honey from soaking into the wood and wasting, or to prevent the taint of the wood from going into the honey, the barrels should be coated on the inside with paraffine or wax, as explained under BARRELS. But wooden packages can be used only in the Eastern or Middle States. In the Western States, especially Arizona, Colorado, New Mexico, and California, square tin cans holding about 60 lbs. of honey are about the only shipping-package that can be used; for the dryness of the climate will cause the wooden packages to shrink so as to be entirely useless with any kind of treatment.



60-lb. honey-can and honey-gate.

The square tin cans of the West have come to be so popular that they are now, to some extent, displacing barrels in the East; for the wooden packages have a fashion of leaking, and running out on the bottom of the car, causing commission men and honey-merchants no end of trouble; and there is danger that the wood will give the honey a taint unless waxed on the inside, as explained; but the trouble is, many beekeepers won't take the trouble to do this, and the honey therefore sells at a lower price. If the tin packages are tight in the first place, they will remain tight; and no degree of dryness will in the least affect them; and while they are somewhat more expensive per pound of honey, yet this disadvantage is offset by the convenience in retailing or wholesaling any amount less than 100 lbs. If a honey-merchant buys a carload of extracted honey in square cans he can parcel it out in 60 lb., 120 lb., or multiples thereof, just as he likes, without breaking or opening a package.

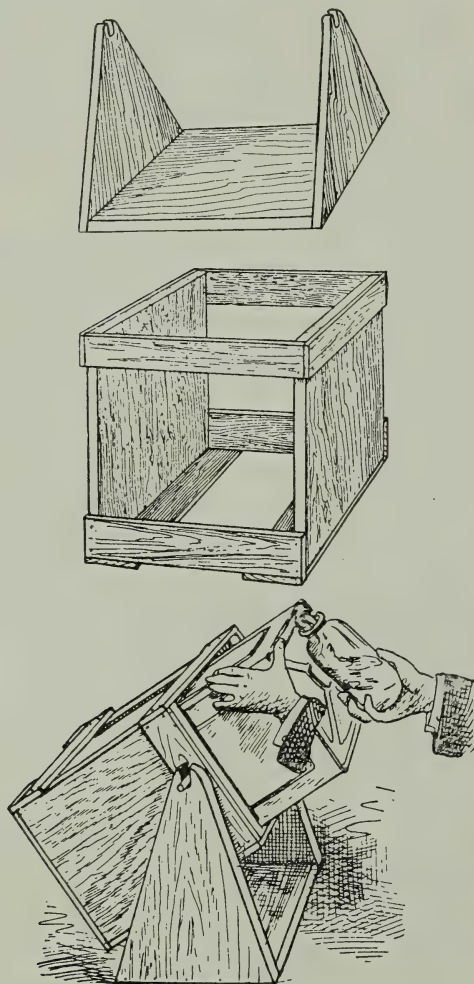
There is still another point in favor of the cans; namely, there is never any loss of honey by its soaking into the package. In the case of barrels or kegs, this loss of honey sometimes runs up to two and even five per cent of the total amount of honey, and this is considerable. When it is borne in mind that wooden packages must be bone dry, and well coopered, one can see that a large amount of honey might soak into the pores of the wood. This, of course, can be overcome by paraffining inside; but that involves considerable labor.

Of course, the square cans have to be boxed—usually two in a box—as shown. They are sometimes boxed separately.

A honey-gate is shown in an enlarged view at the right, below the large cut. It is made of a piece of stout charcoal tin, $2\frac{1}{2}$ x3 inches. A bit of heavy leather is fastened by four rivets to this tin. The leather is 2x3 inches, so that we have $\frac{1}{4}$ inch of the tin projecting on two sides. Fold this tin which projects, in such a way as to take in the tin slide, as shown in the cut. With a tinner's punch, cut a hole through the leather and tin. In like manner make a hole through the screw cap, and solder to the tin, as shown in the cut. This gives us a honey-gate that will fit on any of our square honey-cans, so the grocer need have but one honey-gate, which he can attach to his square cans as fast as he retails from them. These gates should not cost over 15 cts.

A HANDY DEVICE FOR EMPTYING SQUARE CANS.

An ordinary 60-lb. square can full is a rather awkward thing to handle when it is desired to get a small quantity of honey out of it for a customer who comes with a pail and wants only "a little." In tipping it over at an angle to let the honey run out, it is so heavy that it is difficult to keep at the right balance so as not to run out too much, or daub the can or pail. Mr. G. C. Greiner, of LaSalle, N. Y., sent a sketch of a very



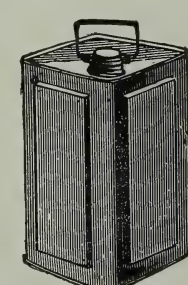
A handy device for emptying square cans.

handy device, and so simple that anybody can make one out of the material in an ordinary drygoods box. The illustration will make its method of construction as well as its manner of use perfectly plain. When a can is pivoted on its centers on each side, it can be tipped to the proper angle very easily. When the package is full, the can may be instantly tipped up to a perpendicular. When one can is empty, another one can be put in its place, and the operation repeated. The screw top should always be at the top to let the air in as fast as the honey flows out—otherwise the honey will come out in spurts. A honey-gate can be used or not as desired.

To meet the wants for a smaller package on the same plan, manufacturers have introduced a 1, ½, and ¼ gallon capacity square can with sizes of 12, 6, and 3 lbs. of honey, shown in the accompanying cut. The gallons are put up in boxes of ten each, and are sold at $1.50 per box, or $12.00 per hundred without boxing. In many cases it may be desirable for the dealer to order a part of his extracted honey in 60-lb. square cans and kegs, and a part in the 12-lb. square cans, so that he can distribute to his customers according as they want a large or small package of honey.

HOW TO TEST SQUARE CANS FOR LEAKS.

A. J. Hill, of Florida, recommends the following plan: Place the mouth over the aperture, and suck out the air into the lungs and exhale through the nostrils. By repeat-



One-gallon 12-pound square can.

ed drafts, that necessarily become shorter, a partial vacuum is made in the can. Stop a minute, and listen for leaks. If there are any, a hissing sound will be heard, and the decreasing air-pressure will allow the sides to crack back into place. These cans should be discarded, and repaired later. Scald out after testing.

SECOND-HAND CANS, AND HOW TO CLEAN.

Square cans are used very largely for sending gasoline and kerosene to the Pacific coast. After they are emptied they are sold for about half what new ones cost, and in many cases beekeepers have used them, almost ruining their honey. Some of the

more careful ones have washed them out. The one who has succeeded best, and claims that second-hand cans are exactly as good when so treated, at about half the cost, is Mr. S. S. Butler, of Los Gatos, Cal. He writes:

I melt off the four faucets by setting four cans, with the corners that have the faucets together, putting a shovel of hot coals on them. A good worker can clean about 100 in a day by putting a handful of unslacked lime in each, with 3 or 4 quarts of boiling water. After it is slacked, rinse it well, and afterward rinse out twice with cold water, washing them twice with lime. In that way it will clean them perfectly.

During 1909 there was considerable discussion in *Gleanings in Bee Culture* as to whether even the new tin cans are clean enough to put honey in without washing out. Some have claimed that they are more or less dusty inside and should be rinsed out with hot water. The difficulty comes of drying out the cans on the inside, afterward; for if any drops of water are left in the can they will make rust spots, resulting in leaks or the discoloration of the honey. As to whether new cans should be washed out or not, will depend very greatly upon the cans themselves. If they appear to be bright and clean we should say that one would be running a risk to attempt to wash them out again.

EXTRACTING.—Briefly stated, extracting is a method to remove the honey from the combs by centrifugal force, thus making it possible to save the combs so they can be put back into the hives and refilled. The process is called extracting and the machine the extractor. When it is understood that bees require anywhere from 3 to 6 lbs. of honey to make one of wax, and that it takes an ounce of wax to hold a pound of honey, it will be seen there is a big economy in saving the combs.

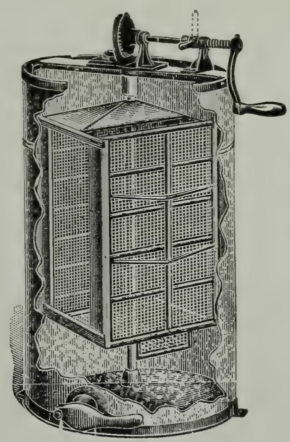
EXTRACTORS.

The honey-extractor, like the modern movable frame, is one of the things that have made a revolution in beekeeping. It was invented in the year 1865 by Major de Hruschka, of Venice, who died at the good old age of 75, in the year 1888. Like a good many other inventions, its discovery was made by accident. His little boy chanced to put a piece of comb in a basket to which was attached a bit of rope. With rope in hand, the boy began to whirl it. The centrifugal force caused a few drops of honey to be thrown out of the basket around in the air, and the father, seeing it, was keen enough to see that in this there was a *principle,* and the nucleus of a big invention whereby it would become unnecessary any longer to crush the combs and strain the honey out in the old-fashioned way. He very soon constructed a rude extractor that demonstrated the practical utility of the discovery; and, shortly afterward, perfected the machine.

Among the early extractors brought out in this country was one made by J. L. Peabody. This was so constructed that the whole can revolved, and the honey ran out through a hole cut in the center. But this was poorly adapted to the needs of the beekeeper. In 1869 A. I. Root constructed what he called the "Novice" honey-extractor. This was so great an improvement over all that had preceded, that it found a ready sale at once. The inside baskets for holding the combs revolved; and in order to combine lightness with the greatest strength, were made of folded-tin bars and tinned wire cloth, four meshes to the inch. The crank was geared so that one revolution made three revolutions of the baskets.

REVERSING EXTRACTORS.

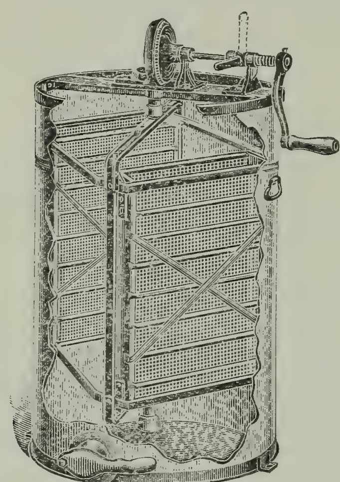
The basket in the Novice extractor requires the pulling-out of the combs in order



Extractor with space for honey below revolving frame.

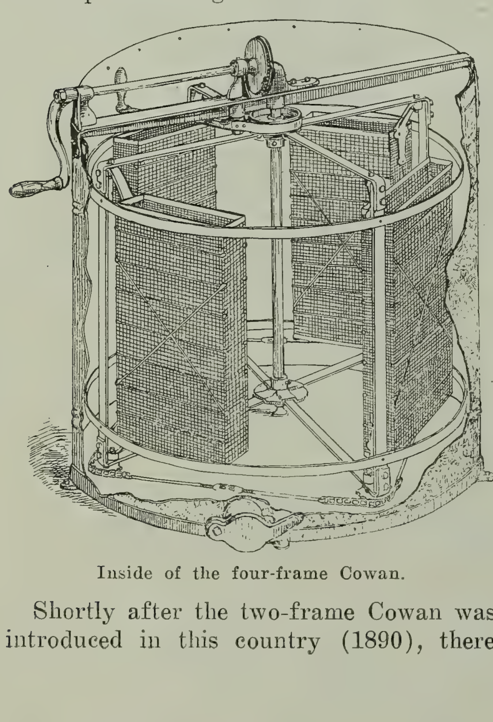
to present the unextracted sides next to the can. This takes time and is unhandy. About the time A. I. Root was experimenting with extractors, Thos. W. Cowan, editor of the *British Bee Journal,* constructed what was then known as and is still called the Cowan reversible extractor. To obviate the ne-

cessity of removing the combs, the pockets, or wire-cloth cages, were hinged, like an ordinary door, to a reel without a center-shaft. Combs could be put into these pockets; and after one side was extracted the pocket could be swung on its hinges the other side to, door fashion, without even stopping the machine, by merely slowing up so the left hand could catch the edge of each pocket, throwing it around. The cut next shown, while it does not represent



Two-frame reversible extractor.

the original extractor made by Mr. Cowan, shows the Americanized machine. The mechanism has been greatly improved in workmanship and design.

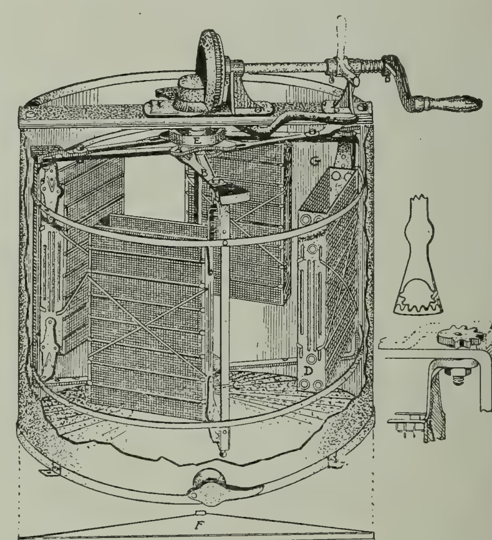


Inside of the four-frame Cowan.

Shortly after the two-frame Cowan was introduced in this country (1890), there came a demand from the beekeepers of the West, who produce honey by the carload, for machines that would do the work in a still more wholesale way than even the two-frame reversible Cowan. In response to this, four, six, and eight frame Cowan machines were made. The same principle of the swinging pockets was used in a large revolving reel, as in the two-frame machines, with this difference, that all the pockets were geared together so that when one was swung around all would be moved at the same time. These soon gave way to the much more efficient

ROOT AUTOMATIC REVERSIBLE EXTRACTOR.

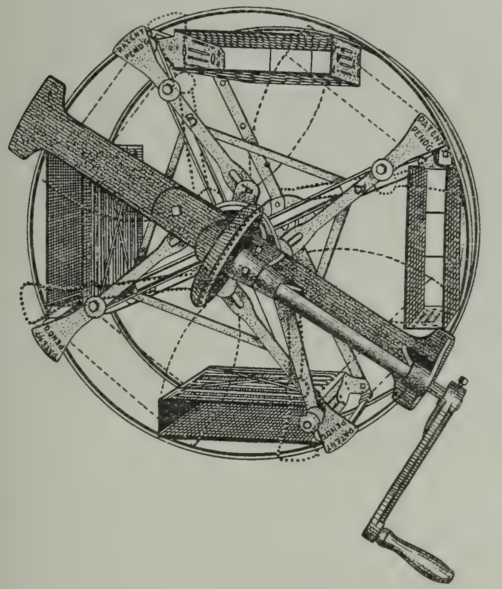
This is an improvement over the old original Cowan because of the fact that it is an automatic reversible machine. The reversing mechanism, the invention of Frank G. Marbach, is situated on top of the reel,



Root's automatic four-frame honey-extractor—side view.

and is actuated by a slight pressure on the brake-lever. This action is always positive and reliable. Other automatic reversing-devices have been put on the market at various times; but they were so complicated in their action, and so likely to get out of order, that they have never become popular. Moreover, they required a reversal of the crank-handle in order to bring about a change in the position of the combs. This placed a heavy strain on the gear-work, causing breakdowns, and very often stripping the cog-wheels of their teeth. This has all been overcome in the Marbach device,

because the strain incident to reversing is placed entirely on the brake-lever, relieving

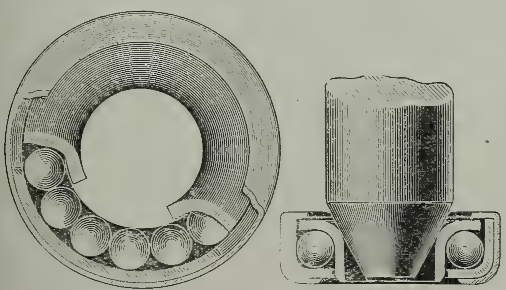


Root's automatic four-frame honey-extractor—top view.

all stress on the gears. Another feature of this machine is that it can be reversed while in motion; a pressure on the brake-lever slows down the reel, when, presto! the combs are flopped the other side to in the fraction of a second—so quickly, indeed, that it seems like a sleight-of-hand performance.

BALL BEARINGS AND SLIP GEARS.

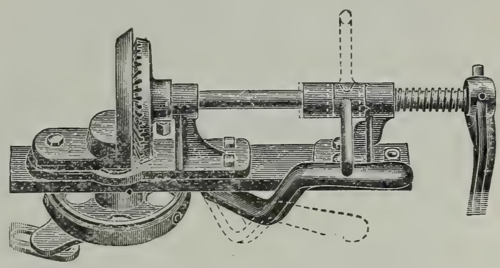
Modern extractors are now being equipped with ball bearings to reduce friction. In



Ball bearings.

hand-driven machines this is of considerable importance. Another feature that is being put on is a slip-gear device shown in the accompanying illustration.

The function of the slip gear is to disengage the crank and large gear wheel from the small pinion that drives the extractor reel. After the machine has been brought up to its full momentum, the lever standing in position of the dotted line is thrown down to the position shown in the cut to disengage the gear; and the reel, now free from the drag of the crank, may hum like a top; and when mounted on ball bearings



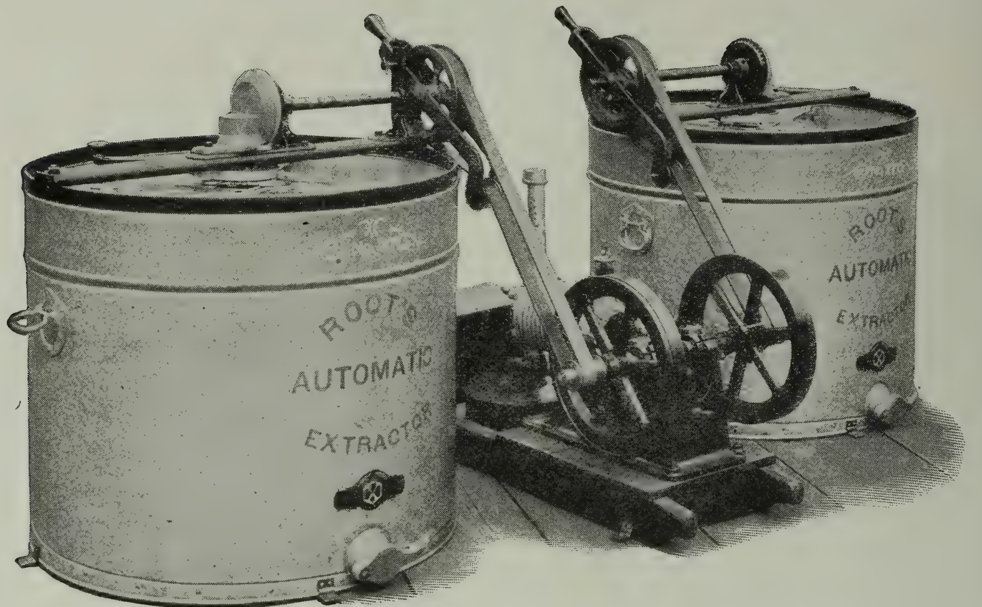
Slip gears.

it will whirl for a considerable time, throwing out honey in the mean time without any effort on the part of the operator. This saves some honey and considerable muscular energy. On the power-driven outfits the slip-gear device is not used of course.

POWER-DRIVEN HONEY-EXTRACTORS.

In some localities, where a large amount of extracting has to be done, the extractors are driven by water-motors, gasoline-engines, or any other small power. Little gasoline-motors have now arrived at such a state of perfection that they are exceedingly reliable and efficient, and in view of the fact that a steam-engine is expensive, and that a water-motor is out of the question for most localities, the internal-combustion engine, driven by the force of an explosion, is the most available power for this purpose. Small air-cooled engines of this type are now made in one and two horse-power sizes that will drive a honey-extractor with a consumption of gasoline of only one quart for a run of ten hours, and the cost of the engine is only from $50.00 to $75.00 at the factory, and they are so simple in construction that any child capable of reading and understanding directions can manage them.

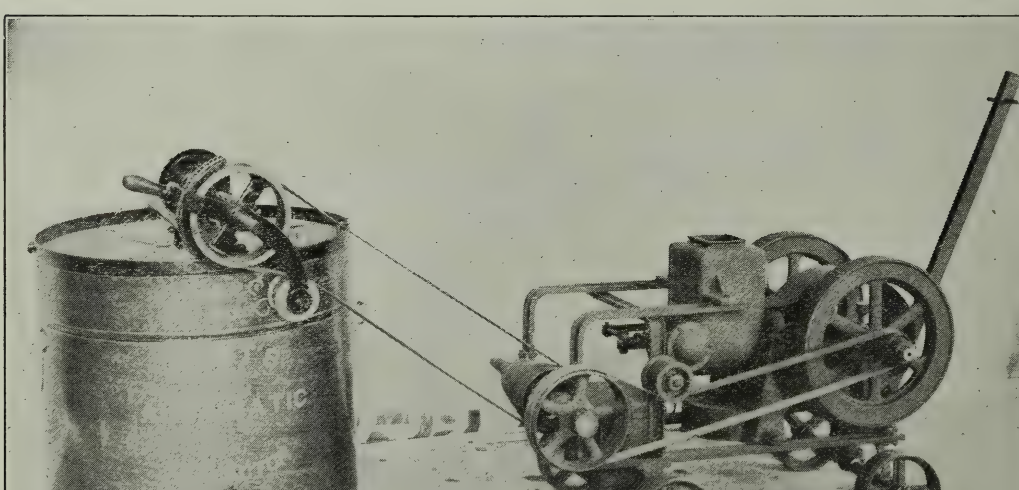
The method of transmitting the power of the engine to the machine is shown in the accompanying illustrations. In view of the fact that it is not practicable to stop and start a gasoline-engine every time the combs are taken out of the extractor, and replaced, a loose belt with idler is employed so that the extractor can be stopped and started—in fact, any speed desired obtained—simply



One engine driving two large four-frame extractors. The advantage of this arrangement is that one extractor can be emptied and filled with combs while the other is extracting. In this way the work of extracting can proceed without interruption.

by a pressure on the lever that holds the idler used to increase the tension of the belt. This form of transmission of power has been tested thoroughly, and found to be a success in every way.

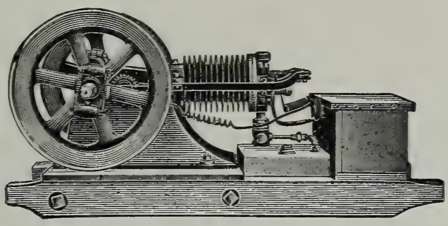
Where a large amount of extracting is to be done, this gasoline-outfit, together with an eight-frame extractor, will almost pay for itself in one season. On the other hand, an extractor run by hand power takes a



The New 60-speed engine made by the Gilson Manufacturing Co., Port Washington, Wisconsin. The particular feature of this engine is the jack-shaft and series of interchangeable pulleys by means of which 60 different driving speeds may be secured, so that the engine may be used to run any thing from a grindstone to an emery wheel without expensive pulleys, shafting, and belts. They should appeal to the beekeeper.

good strong man, whose services can not usually be had for less than $2.00 a day.

But experiments have shown that a honey-extractor driven by power will do quicker and more thorough work. It is impossi-

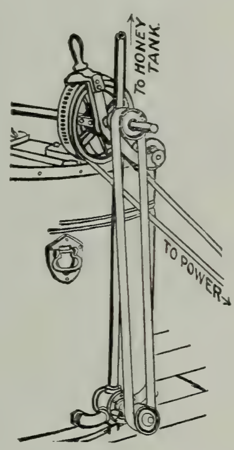


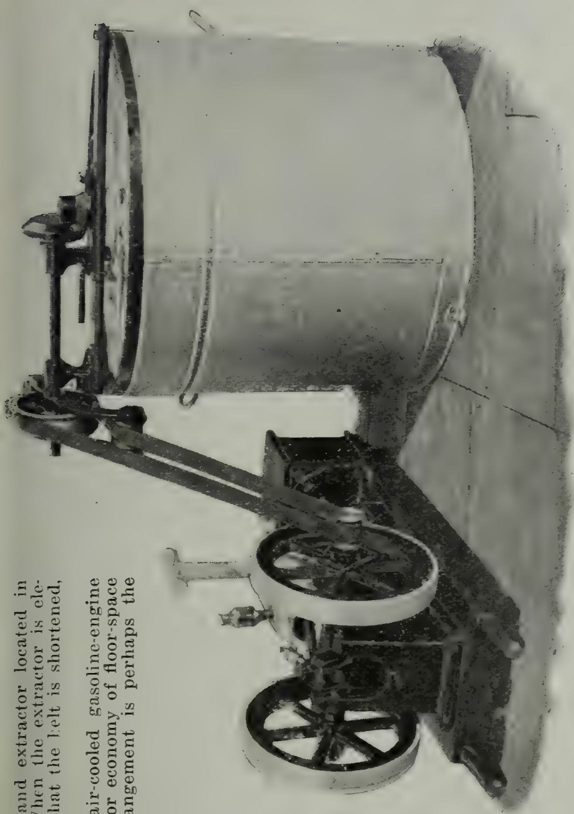
Air-cooled gasoline-engine.

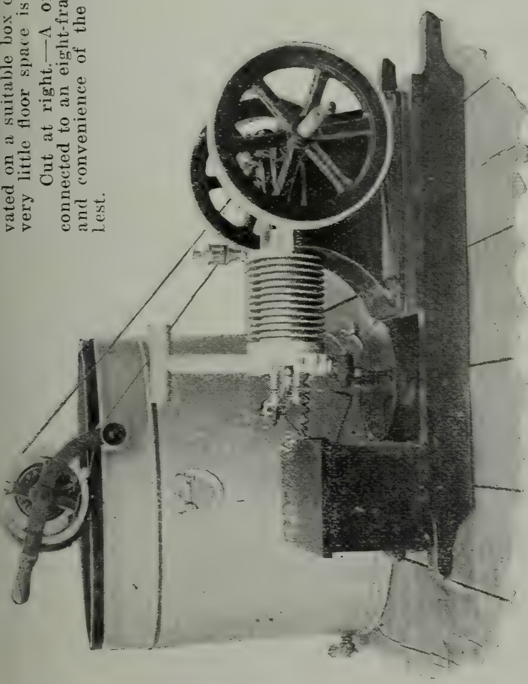
ble by hand power to do a clean job of extracting; and the result is, the combs go back into the hive very wet. While a good portion of this honey will be stored back, experience shows that a large part of it will be consumed by the bees.

HONEY-PUMP.

It has been found that small gear pumps, such as are used for pumping oil, answer admirably for pumping honey. Two or three of the large bottlers of honey in the United States use such a pump operated by a small electric motor. In the case of extractors it has been found possible to connect one of these pumps and operate it by means of a belt from the horizontal reel of the extractor, so that, as fast as the honey accumulates in the bottom of the can, it may be elevated automatically to a tank in a room overhead, or to any part of the building where extracting is being carried on. This makes it possible to have the extractor on the floor, without the necessity of stepping up on to a platform to put in and take out the combs, and at the same time deliver the honey to any point that may be desired. Ordinarily an extractor requires to be mounted on a platform a foot or more above the floor, so that the honey may run by gravity from the honey-gate into some container like a pail.





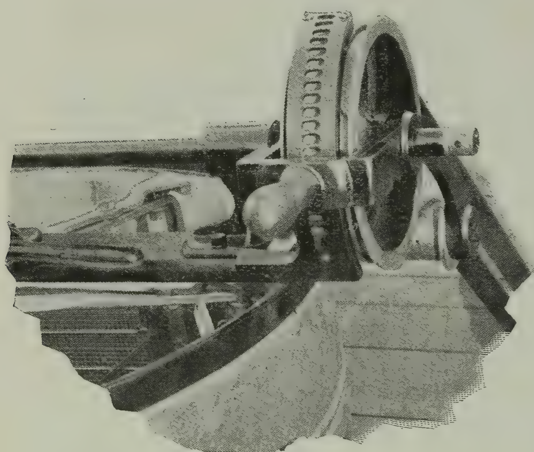


Cut at left.—Side view of engine and extractor located in the same position as shown at right. When the extractor is elevated on a suitable box or platform, so that the belt is shortened, very little floor space is needed.

Cut at right.—A one-horse-power air-cooled gasoline-engine connected to an eight-frame extractor. For economy of floor-space and convenience of the levers this arrangement is perhaps the best.

RIGHT AND WRONG PRINCIPLES IN HONEY-EXTRACTORS.

Some of the earlier machines sold in this country, notably the Peabody, made use of a revolving can without gearing. This was



The idler-lever in position so that the belt is tight.—By means of our new ratchet device the idler will remain firmly fixed in any desired position.

a mistake. For the last twenty years extractors have been built with *stationary* cans, inside of which the comb-pockets, reversible or non-reversible, revolve, motion being imparted by gearing so that one turn of the crank-handle makes two or three turns of the baskets.

MORE EXTRACTED THAN COMB.

Some of the advantages and disadvantages of using a honey-extractor in the apiary are considered under the head of Extracted Honey. That more honey can be obtained by the use of the machine than by having it stored in section boxes in the shape of comb honey, all are agreed; but all are not agreed as to *how much* more. If it is nicely sealed over as it should be before being extracted, we do not think more than half as much more will be obtained, on an average, although the amount is placed by many at a much higher figure. A beginner will be likely to get more extracted than if he relies upon having the bees work in sections; he will also be much more apt to take away too much, and to cause his bees to starve. This last is an unfortunate feature attendant upon the use of the machine, especially where the beekeeper is prone to carelessness and negligence. To secure the best results with the extractor, plenty of empty combs should be provided, that ample room may be given, in case the hives should become full before the honey is ripe enough to remove. If a second story does not give room sufficient, add a third for a heavy stock, during a good yield of honey.

HOW TO EXTRACT.

Much will depend on whether one has a large amount of honey to be extracted, or whether he is only a novice and wishes to use the simpler and cheaper methods. If he keeps bees in only a small way, and

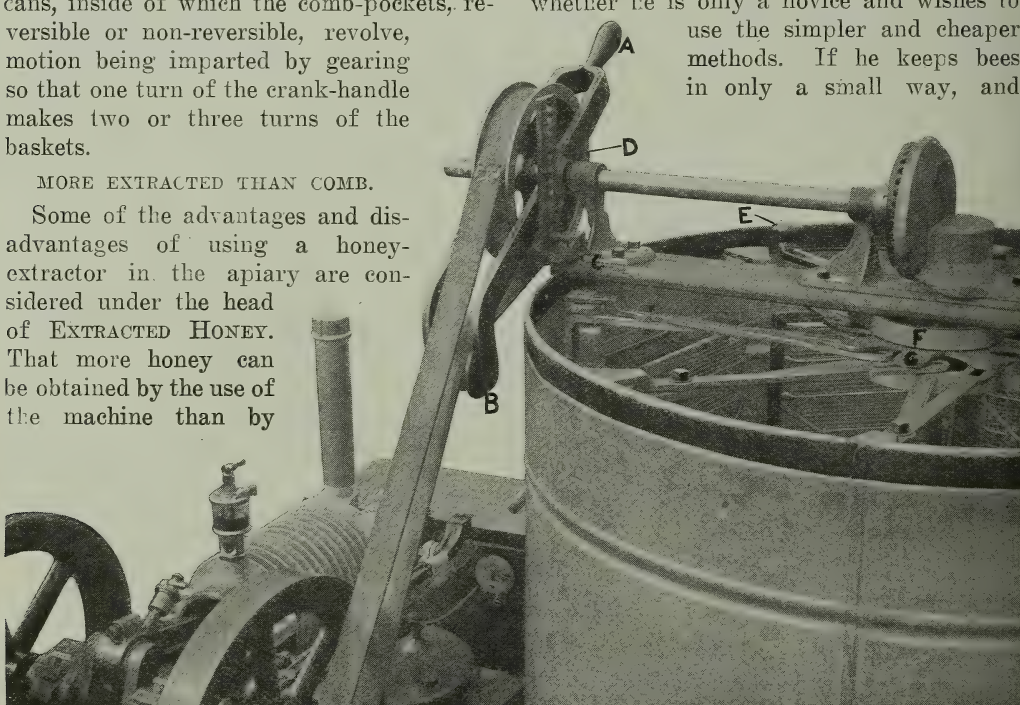


Fig. 7.—How to operate the extractor. To start the extractor push down on the handle A. This moves the idler, B, up, tightening the belt up so that the reel begins to turn. To reverse the baskets, release the idler and pull on the brake-lever, E, thus tightening the band, F, and causing the reversing-hub to move slower than the reel. This difference of speed in the motion of the hub and the reel reverses the baskets.

probably will not extract to exceed two or three thousand pounds in a season, the ordinary Novice two or four frame extractor will answer his purpose; but as he seldom foresees that he may go into the business extensively, it would be better to purchase a reversible extractor. One of these will save labor, do quicker work, and more of it.

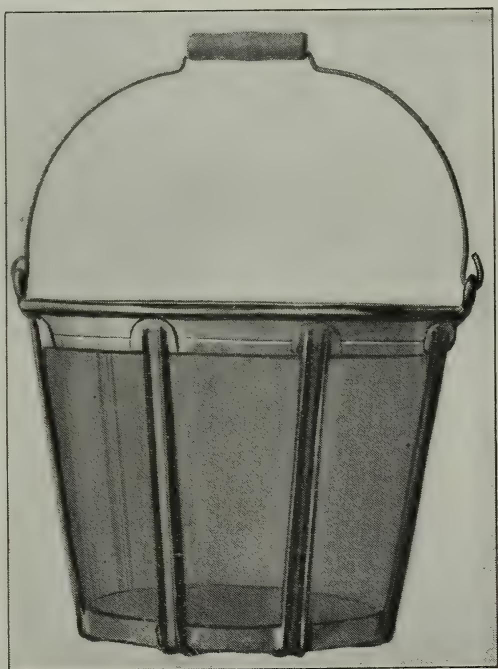
Having selected the machine, it should be placed on a box or hive-body about as large as the bottom of the can, and about as high

Extractor elevated on a hive-body.

as an ordinary water-pail; that is to say, the extractor should be elevated high enough so that the honey-gate may empty into a common pail, something as shown in the above illustration. Both box and extractor should be securely anchored down. As fast as the honey is extracted it is to be drawn off pailful after pailful, and then poured into kegs, square cans, or any large receiving-vat for holding the honey. This filling and emptying of the pails may seem to involve quite a little labor; but one of the largest honey-producers in the world, Mr. W. L. Coggshall, uses identically this method.

Some prefer to have the extractor on a higher box so that the honey-gate can stand just over the bung-hole of a barrel, thus allowing the honey to go directly from the comb into the marketing-package. But this necessitates raising the extractor to a point so high in the air that it is not convenient to work, and awkward to put in and remove the combs. It is, therefore, desirable that the machine should be as close to the floor as possible on a low box, low enough so we can run the honey into the pail, or direct into square cans; but if the honey is first run into an open tin pail, its quality, and whether or not there are dead bees floating in it, can be seen before it is emptied into the regular marketing-packages.

For a strainer a cheese-cloth sack attached to the honey-gate will answer very well in a small way, although something more elaborate will have to be used where the extractings are conducted on an extensive scale. It is then customary to run the honey through a strainer having a large



Alexander honey-strainer.

surface, not less than three or four square feet. Or the honey may be conducted into large tanks, where all particles of comb can rise to the top and be skimmed off. The honey is then drawn off from the bottom into square cans and barrels.

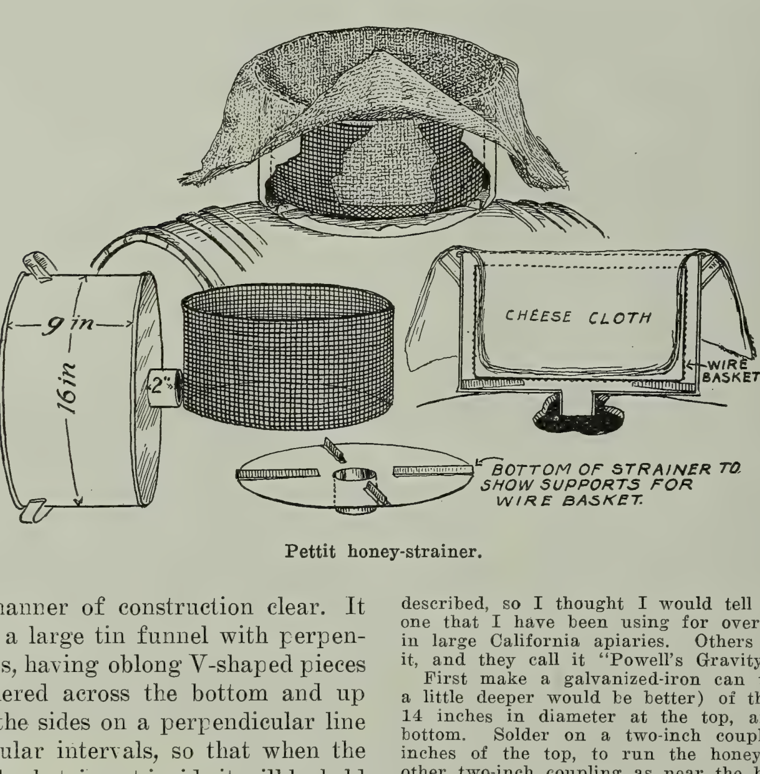
Mr. E. W. Alexander used an ordinary ten-quart milk-pail, cutting out the sides and bottom of it, leaving a top and bottom rim. These are united by upright tin braces as

shown. The open spaces are next filled in with a fine mesh of brass wire cloth, secured in place by solder. A good tinner should be employed to do the job. When finished it makes a large pail sieve. This he hangs over the discharge-pipe of his extractor, and he finds it ample to take care of the output of a four-frame machine run to its fullest extent. He advises, however, having two pails, so that when one is clogged up another one can be put in its place; then, after the day's extracting is over, both can be cleaned.

S. T. Pettit, of Aylmer, Ontario, Canada, has devised a strainer which we consider superior to any thing else that is here shown. The accompanying illustration will make its manner of construction clear. It consists of a large tin funnel with perpendicular sides, having oblong V-shaped pieces of tin soldered across the bottom and up and down the sides on a perpendicular line and at regular intervals, so that when the wire-cloth basket is put inside it will be held away from the sides of the funnel by a distance equal to the pieces of V-shaped tin. Inside the wire-cloth basket is hung a square of cheese-cloth that does practically all of the straining. This cloth comes in contact with the wire-cloth basket; and as this has a space of practically half an inch between it and the walls of the funnel, the honey can run down between, through the two-inch pipe into the barrel.

The special feature of the Pettit strainer is that extra squares of cheese-cloth can be substituted when the one already in shall be clogged with refuse. These can be rinsed out later on and be used again.

These straining devices, as nearly perfect as they are, leave something to be desired. A number of extensive producers throughout the country are using gravity in connection with screens to separate particles of wax, propolis, and dirt from the honey. Of all the gravity honey-strainers we have seen, the one described by Mr. Powell, of Riverside, Cal., appears to have the most desirable features. Mr. Powell describes it as follows:



Pettit honey-strainer.

I have read GLEANINGS for over thirty years, and have yet to see a good practical honey-strainer described, so I thought I would tell how to make one that I have been using for over twelve years in large California apiaries. Others have adopted it, and they call it "Powell's Gravity Strainer."

First make a galvanized-iron can the depth (or a little deeper would be better) of the honey-tank, 14 inches in diameter at the top, and 12 at the bottom. Solder on a two-inch coupling within 4 inches of the top, to run the honey in, and another two-inch coupling as near the bottom as possible (on the opposite side). Solder one more coupling 1½ inches in size for a honey-gate to empty the strainer at the close of the day's extracting.

Inside of this can place another can with a strainer bottom, so made that it will slip into the outside can below the coupling that lets the honey in, and remain supported within 4 inches of the bottom of the outside can. This inner can must fit snug at the top, so nothing can pass down between the two.

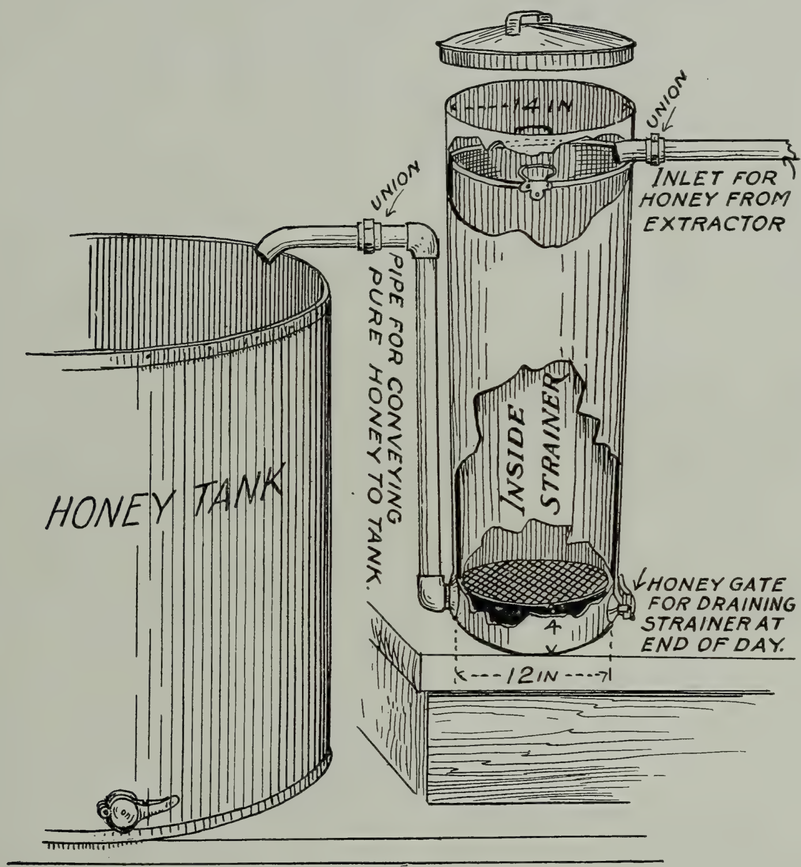
To connect the strainer with the honey-tank and extractor, use two-inch galvanized-iron pipe, placing a union between the extractor and the strainer. Have the strainer at least 12 inches higher than the honey-tank, so there will be plenty of gravity flow. The pipe from the strainer to the

tank should come up to a point eight inches from the top of the outside strainer-can, and then turn with an elbow over to the tank.

The strainer will always be full up to the level of the outlet, and all the impurities will stay on top of the honey, and the screen will have little or nothing to do, and will never clog (unless there is granulated honey in the combs that would find its way to the bottom and choke the strainer). At the close of the day's extracting draw out the honey from the strainer by means of the gate, and during the night the refuse will be drained clean of honey, so that the inside can may be lifted out and washed.

It is best to fill the strainer at least half full with clean honey so as not to stick wax, etc., on the screen to start with; after that it will take care of itself by the aid of gravity.

This strainer will do just as good work without the inside strainer, but it would be hard to clean, and one could not strain the honey left in the can. The capacity of this outfit is from four to eight tons of honey a day, and no attention whatever is required.



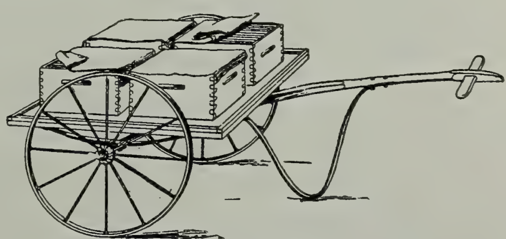
Powell's improved gravity strainer; capacity eight tons of honey per day.

TAKING THE COMBS TO THE EXTRACTOR.

We next come to the matter of getting the combs out of the hives, transporting them to the extractor, and uncapping them. We shall need a wheelbarrow or handcart —preferably the latter, for the wheels are large, and the burden is sustained entirely by the cart.

COGGSHALL'S EXTRACTING-CART.

This, as will be seen, is nothing but a handcart without a box. The tray or bottom has cleats around the outer edges, to hold the hive bodies or supers that are placed thereon from sliding. This cart, with the supers, is run close to a hive. Over the whole four, or over each one individually, may be placed a wet cloth or cloths, the purpose of which is to shut out robber bees that may be hovering around;

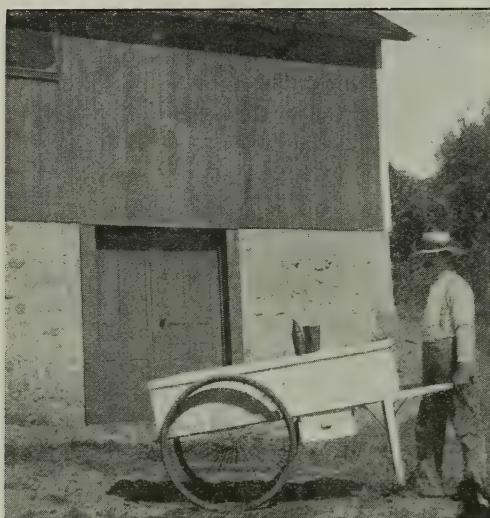


Coggshall's extracting-cart.

for bees are disinclined to push up under *wet* cloth.

Some prefer a light spring wheelbarrow holding one or two empty hive-bodies. Mr. William Lossing, of Arizona, makes use of a foot-lever closing device over the hive.

Mr. L. E. Mercer, of California, uses a sort of two-wheel barrow with pneumatic tires, and a long box in which to receive



Mercer's cart.

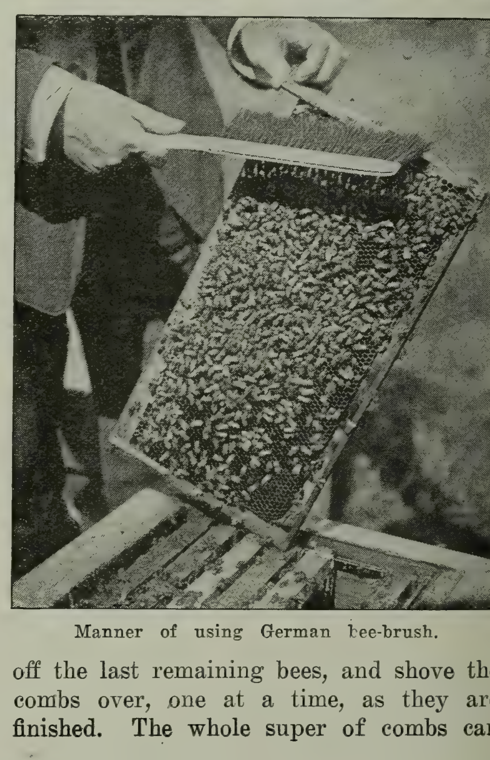
the combs. The bicycle-tires and wheels make the vehicle much better for carrying the combs over ordinary rough ground.

GETTING THE BEES OFF THE COMBS.

We next open the hive, pull out one comb and give it a rapid shaking motion in front of the entrance. The Coggshall or the German bee-brush attached to the waist by means of a string will brush off the remaining bees. The frame should be held by one corner and one side and then the other be brushed as shown in the views below. Or, if preferred, the comb may be rested on the hive, and brushed. We then place the frame in one of the supers on the cart or barrow. The next comb is then removed; but instead of being shaken in *front of the entrance* it is shaken *in the hive.* The few remaining bees are then dislodged with the brush, as before explained.

Some prefer to shake one or two frames in front of the entrance, and then shake all the other frames in the super or upper story in the space made vacant. There is an advantage in this, as it avoids getting the bees all over the ground, and at the same time it enables one, after shaking, to brush the combs one at a time, clean

How to hold the Coggshall bee-brush.



Manner of using German bee-brush.

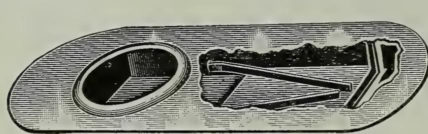
off the last remaining bees, and shove the combs over, one at a time, as they are finished. The whole super of combs can

FIG. 4.—Brushing the bees from the outside comb and from the edge of the hive. FIG. 5.—Brushing them from one side of two combs. FIG. 6.—Transferring the beeless combs to the wheelbarrow. FIG. 7.—Shaking the bees off the last comb.

then be lifted off at one operation, and placed on a wheelbarrow. Otherwise it is necessary to handle each comb separately after being brushed.

In this way one or more supers on the carrier are filled with combs, and are then wheeled to the extracting-house. Arriving here they are taken care of by a couple of helpers. We then take back with us on the cart four other empty supers, which are filled as were the others; but where one carries on beekeeping in a limited way, an ordinary wheelbarrow with two supers on would answer. In that case one operator might take off combs, run them into the extracting-house, extract them, bring them back, and put them on the hive again. Or he might put in the house a dozen or so of supers and then extract. The method or methods can be varied to suit the individual conditions that may exist; but in any case the importance of having pants tucked in the tops of boots, or, if shoes are worn, in the tops of the stockings, is urged; for, during the operation of shaking the combs, the bees will almost surely try to crawl up one's trousers legs. It would also be a wise precaution to have long sleeves, on the ends of which are sewed gloves having the finger-tips cut off. These, when put on over the coat or shirt sleeves, will prevent the bees from crawling up the sleeves or attacking the wrists. See GLOVES FOR HANDLING BEES.

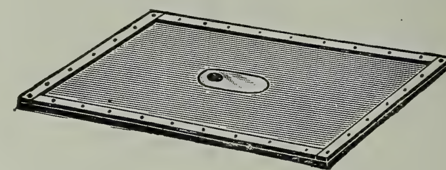
But this annoyance of bees crawling up the trousers legs, of shaking and brushing of the bees, of the danger of stings and robbers, may be avoided to a certain ex-



Porter bee-escape.

tent by the use of the bee-escape. See COMB HONEY. While the device works well in removing bees from supers of comb honey, bees are inclined to cling to extracting combs, and it may be two or three days before all of them will be out of the supers; and even then there may be some left. When running for extracted honey, some have said that it is advisable to use two escapes in a board to facilitate the removal of the bees.

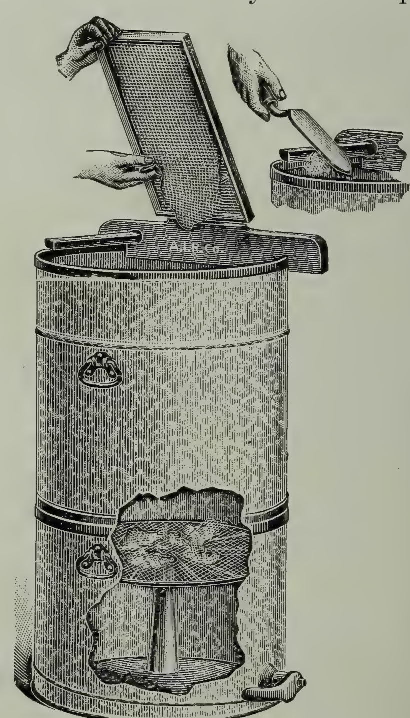
As explained under COMB HONEY, the escapes should be put on the night before. But when the bees are at an outyard this involves an extra trip, and the use of an extra appliance. It is our belief, based on extensive correspondence, that the major-



ity of extracted-honey producers prefer to shake and brush, for then a yard can be cleaned up at one trip. When yards are located miles and miles in all directions it is important to cut down travel as much as possible.

UNCAPPING.

In dry climates the combs may be taken out of the hive when they are half capped

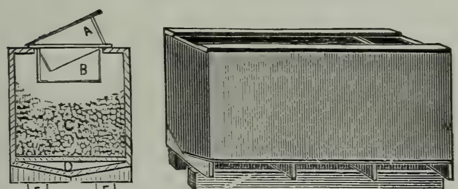


Dadant's uncapping-can.

over; but it is a much safer rule to wait till the cells are pretty well covered before attempting to extract. The honey will be thicker and richer, will sell better, and the product will always be in demand from that time on.

The outfit shown in the previous column is something like an ordinary extractor-can, only it is made in two pieces—the upper one slipping into the other. A wire-cloth partition, as shown in the cut, catches the caps as they fall, and the honey drips down, to be drawn off through the gate. The very finest of the honey will come from this uncapping-can, as it has all been ripened and sealed. A wooden cross-arm extends across the top on one side. A scraping-stick (to clean the knife on) extends at right angles, and is at a convenient height. Centrally through the intersecting piece at one end passes a screw which may be lowered or raised, and the end of which is sharpened to a point. On this point the frame to be uncapped is pivoted, so that one side or the other can be turned very readily for the knife. The cappings, as they fall, easily pass down between the two side arms, dropping on to the screen below. The honey-knife can be readily scraped on the wooden scraping-stick in the manner shown in the illustration, without dulling the edge.

M'INTYRE'S UNCAPPING-BOX.



The cut above shows the device used very successfully by Mr. J. F. McIntyre, one of those extensive beekeepers in California who produce honey by the carload, and the following is his description, taken from *Gleanings*, page 770, Vol. XVIII.

It is 2 feet wide, 2 deep, and 6 long outside, made of ⅞ lumber dressed on both sides. The bottom is 2 inches lower in the middle than at the sides, and is lined with tin to keep it from leaking. Eleven pieces of wood, 1x1x22 inches, are laid across the bottom about 6 inches apart to support the screen which the cappings fall on. This leaves room below the screen for the honey to run to one end, where it passes out through a tin pipe. Two pieces, ⅞x3x72 inches, are nailed on the top edge, one on each side, to contract the top of the box to the same width that a Langstroth hive is long inside.

One piece, ⅞x22¼ in., is fixed across the top of the box about 14 inches from one end, with an iron pivot sticking up through it, 1½ inches high to rest the combs on. When uncapping you set one end of the comb on this pivot, uncap one side, whirl it around, and uncap the other side, and set the comb in the end of the box, as in the diagram. When we have a surplus of combs we often hang them in the other end of the box. In the diagram, C is cappings, and D the space for the honey to run out.

The bottom of the box is 7 inches from the floor, which leaves room for the honey to run into the strainer arrangement below. This makes the top of the box about 32 inches from the floor, which is about the right height for me to uncap easily. A shorter person might make the box a little shallower, or lay a plank on the floor to give the right height, which is the way I do when my wife uncaps.

I know many will think this box unnecessarily large. I will tell you why I think it is not. When uncapping over a round can like Dadant's, the cappings fall on top of those taken off earlier in the day; and when the can is half full the honey has to pass through such a pile of cappings that it takes a long time for all to run out; and when you put the cappings in the extractor they are heavy with honey. With this box, when a pile of cappings accumulates under the knife we take a four-tined fork and pitch them over to the other end, where they may drain for 4 or 5 days. There is a small stream of honey running out of the box all the time, day and night, during the extracting time; and when the cappings go into the sun extractor they are almost dry. I think it pays well for the extra space in the box, because all the honey which goes into the sun extractor is spoiled for the market.

J. F. McIntyre.

THE TOWNSEND UNCAPPING-BOX.

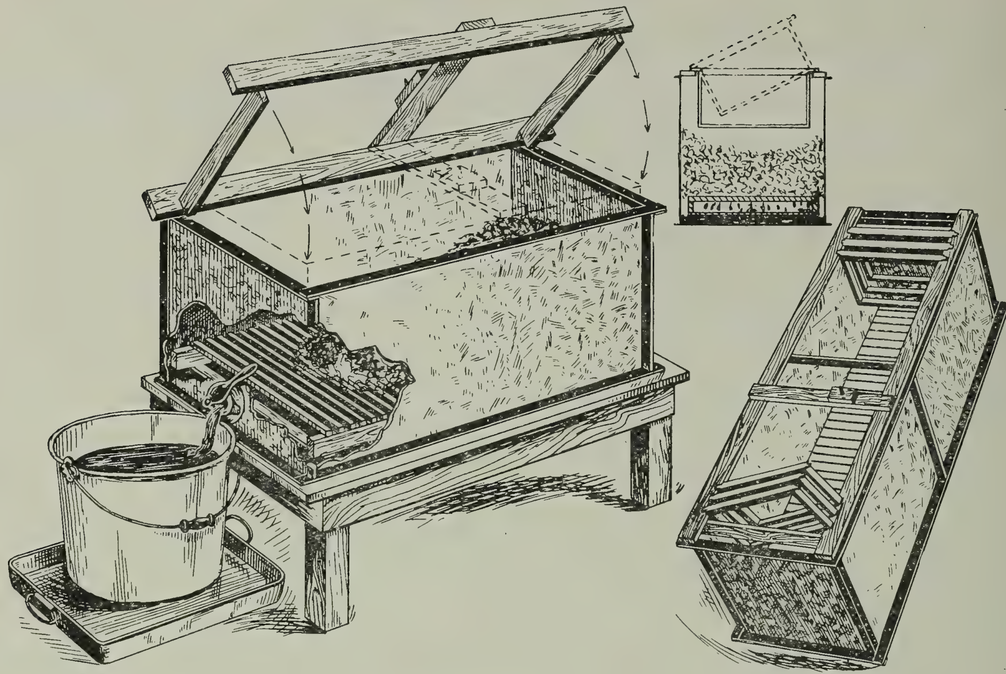
Mr. E. D. Townsend, of Remus, Mich., has made an improvement in the McIntyre uncapping-box, and we hereby submit a cut and description of it as well as a cut and description of his honey-strainer and weighing machine:

Our McIntyre uncapping-box is made of galvanized steel, and is 6 ft. long, 2 ft. high, 2 ft. wide, as shown in the engraving. The slatted frame work at the bottom is made a little smaller than the can so that it may be easily removed to be washed. As there is only a 1½-inch space under this frame for honey storage, we leave the gate open all the time so that nearly all of the room in the tank is available for the storage of cappings as it should be.

The engraving does not show the frame at the top correctly, for the long side-pieces should be close enough together so that the frames can hang between them as though they were in the hives. After the honey is extracted, the combs may be placed back in this rack; but the principal value of the arrangement consists in providing a place where the *uncapped* combs may be hung to drip before they are extracted, for in this way no extra apparatus is needed.

The two short pieces of the framework at the top should be nailed on the bottom of the long side-pieces about 1¼ inches from either end. It can be seen that, when the long side-pieces rest on top of the tank, the short cross-pieces fit just inside, keeping the framework from sliding either way, and yet allowing it to be easily removed when the cappings are taken out. The metal pieces containing nail-points can be tacked on in any position to suit the convenience of the operator.

We have used many different designs of uncapping-boxes, but none seem to me quite so convenient as this McIntyre box. It will hold all of the cappings from one extracting in a yard of ordinary size. We use a six-tined short-handled fork for handling the cappings, and each morning the dry cappings from the day before are pitched up toward one end of the tank, and in this way the honey from the new cappings does not have to drain through the dry ones over and over again as it



Townsend uncapping-box.

would if we were to uncap on top of the cappings left from the day before. In one instance we had more cappings than we could keep in the tank, and a sugar-barrel with a perforated bottom was set over a galvanized steel washtub, and the dry cappings pitched into it. In this way the capacity of the tank may be said to be unlimited. The advantage of the large area of the bottom is that the honey drains out of the cappings much better if they are spread out in a thin layer than it could be in a deep tank where the bottom is comparatively small.

The strainer can is elevated in order to run the honey from the gate into a 60-pound can set on the scales. The gate is open all the time except when the cans were cleaned. An electrical alarm, as first described by Mr. Hutchinson, is used to give us warning when the can is full—see Fig. 2. No one should hesitate about trying one of these alarms, for they are very simple. The engraving shows the method of connecting the bell to the battery. In brief, two wires run from the two posts on the battery to the two posts on the bell; but one wire is broken, one of the ends being fastened to the scale-beam at the pivot, and the other being located just above the outside end of the beam. It can be seen that, when the can is full, the scale-beam rises and the circuit is completed so that the bell rings. It is necessary to have all of the connections tight, as the bell may fail to ring if there are any loose contacts. We set the scales as usual at the 62½-pound mark to allow for the 60 pounds of honey and the weight of the can, and then lay a two-pound weight on top of the can and turn on the honey and go on with our work. It can be seen that, when the scale-beam goes up and rings the bell, there will be 58 lbs. of honey in the can. We then remove the weight and weigh the honey as usual.

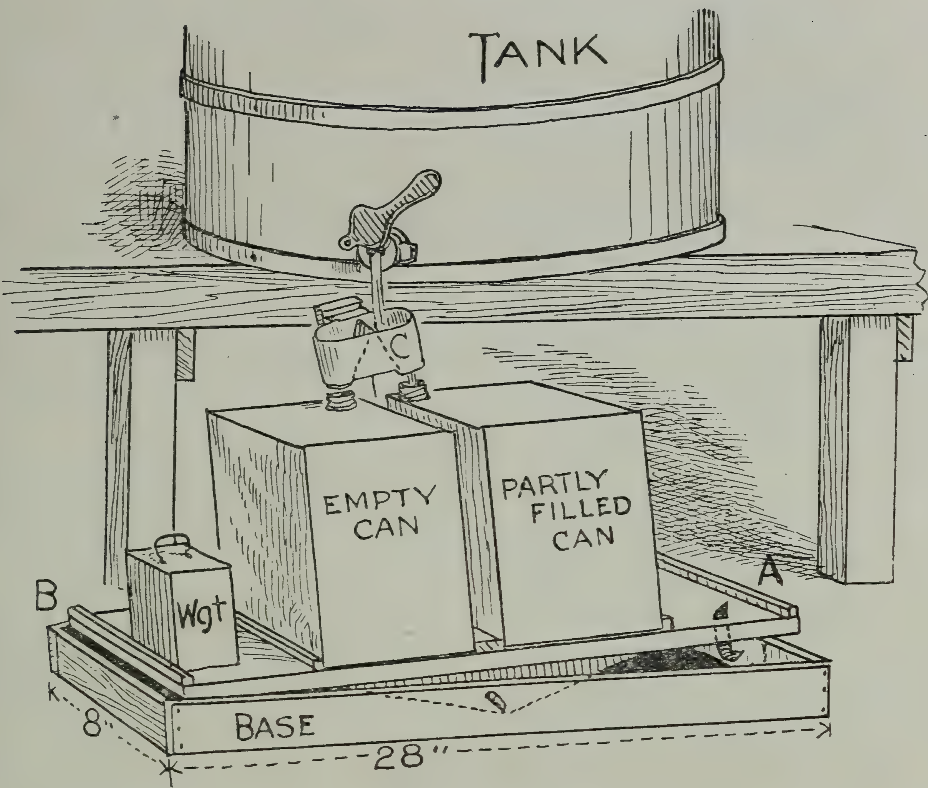
A simpler device is the one used by W. P. Evans, of Fort Collins, Col. Mr. Evans describes it in his own language.

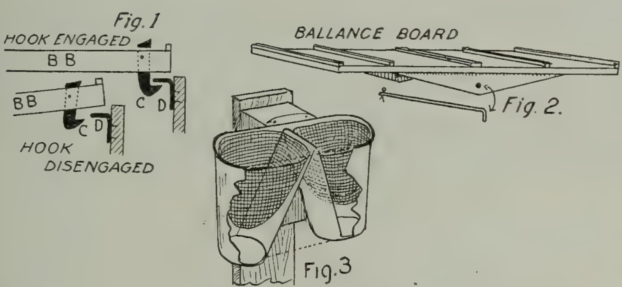
Those who have any amount of honey to run into five-gallon cans will find my automatic device very useful. I have no patent on any part of my outfit, and any one who wishes may make one of them; or, better still, get one made at some factory where the parts can be built more accurately. The capacity of the filler is limited only by the size of the faucet or gate in the honey-tank, as well as by the openings in the cans to be filled. I have canned as much as 800 lbs. per hour without spilling a drop of honey on the floor.

The drawings will make the operation of the device clear. The stream of honey is transferred from one can to another without closing the gate. One can stands on each side of the pivot of a balanced platform. When one can is full it sinks down, thus raising the empty one so that the stream of honey is deflected by means of the double funnel into this empty can. The full can may now be removed, for a steel catch holds this end of the platform down, and an empty one is put in its place. The weight is now transferred to this end of the platform, which weight automatically releases the iron catch at that end, so that, when the can on the other end is full, this first end may rise as before, thus deflecting again the stream of honey. All the attendant has to do is to change the weight from one end of the board to the other and replace the full cans by empty ones.

If necessary an alarm-bell may be easily attached to ring when one can contains the full weight of honey. The bell will continue to ring while the honey is filling the other can, or until the full can is removed, an empty one put in its place, and the weight transferred to the other end of the board. There is no chance for running the honey over, for the attendant may replace the first full can by an empty one any time while the second can is filling.

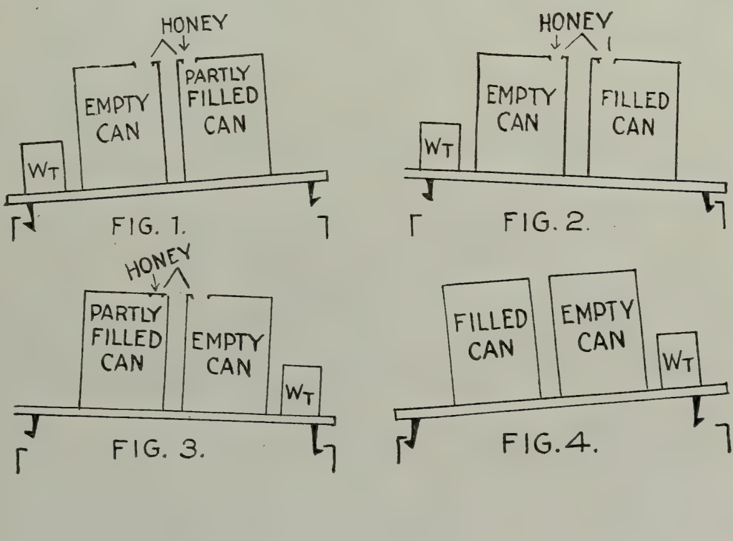
I use a low wide funnel (not shown) on each can, each funnel being provided with a cone-shaped screen that extends well down into it. The construction of the funnel is such that there is no chance for flies or bees to get into the can underneath the funnel, and the screens prevent them from getting in with the honey. Of course, all honey should be well strained before it reaches

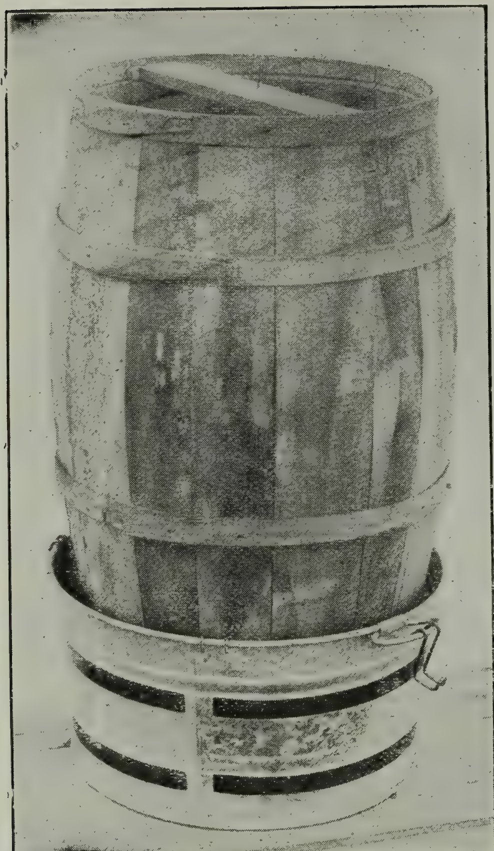




The Evans automatic can-filler. **The** stream of honey runs all the time. When one can is full it sinks down, bringing the other half of the double funnel under the gate.

In Fig. 1 the weight holds the hook away from the catch so that, when the can at the right is full and the weight is overbalanced, the left can will rise and the right hook will engage the catch. The honey now runs into the left can, Fig. 2. The full can on the right may now be removed, for the right catch holds that end of the platform down, and an empty can put in its place. The weight is next transferred to the right end, releasing the catch at the right, Fig. 3. As the can on the left becomes full it sinks down so that the honey again runs into the empty can on the right. Meanwhile the hook on the left has engaged the catch, Fig. 4. The replacing of the full can on the left with an empty one, and the transferring of the weight to the left brings the apparatus back to the position shown in Fig. 1.





these funnels. I use the Alexander strainer, and like it very much.

By changing the size of the weight it is possible to weigh and fill any size of cans. A weight of concrete 8x8x6 inches will weigh from 22 to 24 pounds, which is about the right size to use when filling 60-lb. cans. It should be noted that the weight is further out toward the end of the board than the can of honey, and for this reason it is not necessary to use a weight that equals the weight of a can of honey.

The tilting board, when both cans are removed, should just balance when the base is on a level floor. If one end were higher than the other, the upright piece that supports the double funnel would lean toward the lower end, and therefore cause one can to be a little light while the other one would be correspondingly heavy. I mention this for the reason that one of my friends who was using a filler that I made for him had trouble because the floor was not level. An average floor is all right.

The late W. Z. Hutchinson used a form of uncapping-box (or barrel) that is about as cheap as anything that has yet been devised. His description is as follows:

It is possible that the California plan of melting the cappings as fast as shaved off may prove the most desirable plan; but so far as my experience goes, I have found nothing better than letting the cappings drop into a cracker-barrel set over a tub. Some grocers give the barrels away, if you are a customer; some ask five cents apiece for them, and I never paid over ten cents. The cappings can be allowed to stand and drain for weeks and weeks—no hurry about the barrel; simply pay ten cents for another one.

I bore three or four holes in the bottom of the barrel for the honey to run out. This may not be necessary, as such barrels are not water-tight; but it is a wise precaution to be *sure* there is a place for the honey to run out. Then I nail a wooden cross-piece just inside of the top of the barrel;

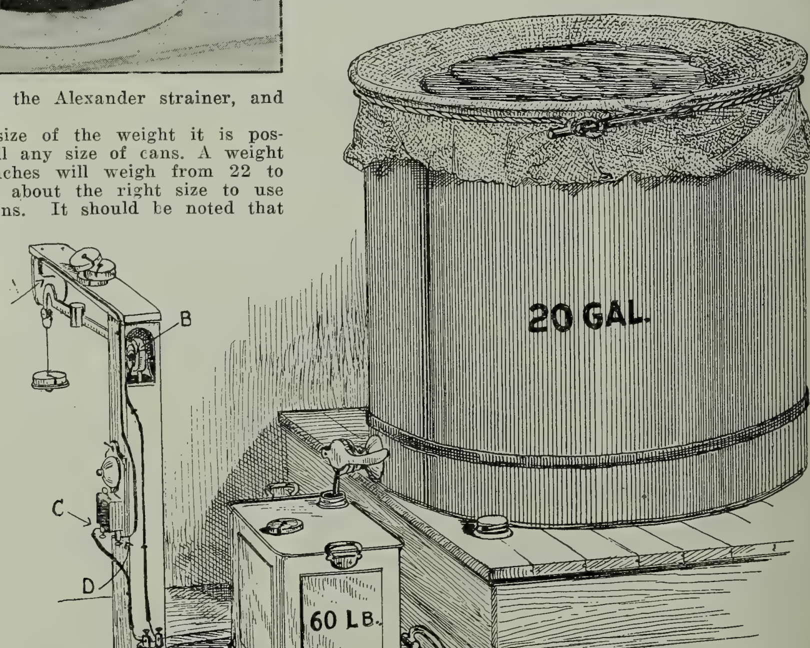


Fig. 2.—E. D. Townsend's arrangement of strainer and scales, illustrating the Hutchinson automatic alarm.

but before nailing the cross-piece in place I drive through it a ten-penny nail; and when putting the cross-piece in place I turn the point of the nail upward.

In uncapping a comb the end of the frame is rested upon this nail-point, which comes as near being a universal joint as any thing with which I am acquainted. The frame can be turned "every which way," and it will not slip about. The barrel is supported over the tub, or slightly below the top, by means of double hooks made of heavy wire. In the accompanying engraving one of these hooks is hung outside upon one of the handles, to show its shape and make-up. Four hooks are used, placed equidistant around the edge of the tub, and the barrel lowered down upon them, the hooks catching just inside the "chime." There is still another plan of supporting the barrel that has the advantage of furnishing handles with which to lift the barrel, and that is to nail two slats of wood to the sides of the barrel, about four inches from the lower end. The slats are nailed to opposite sides of the barrel, at right angles to the staves, and are long enough so that the ends rest upon the upper edge of the tub. The only objection to this plan is that the ends project out slightly beyond the edges of the tub, and are just a little in the way.

CAPPING-MELTERS

The uncapping arrangements so far described have been merely receptacles for holding the cappings, allowing the honey screens, etc., is necessary, especially in a large apiary. Then it is true that not all of the honey will drain out of the cappings. The capping-melter gets all of the honey and gets it very quickly, so that when the day's work is finished nothing is left but a layer of melted wax which, after it has cooled over night, needs only scraping to be ready for market, the honey meanwhile being in shape to strain and empty into the main tank with the rest. Honey that has been taken from a capping-melter strains very quickly because it is warm.

If a capping-melter is crowded too fast or if too small a one is used for the amount of work on hand, it may clog up so that a quantity of the honey will be confined and thus subjected to the heat for a considerable length of time. This means that it is quite likely to become darkened and scorched slightly in flavor. With a properly designed melter, however, or one that is large enough for the work on hand, there is scarcely any difference to be noticed be-

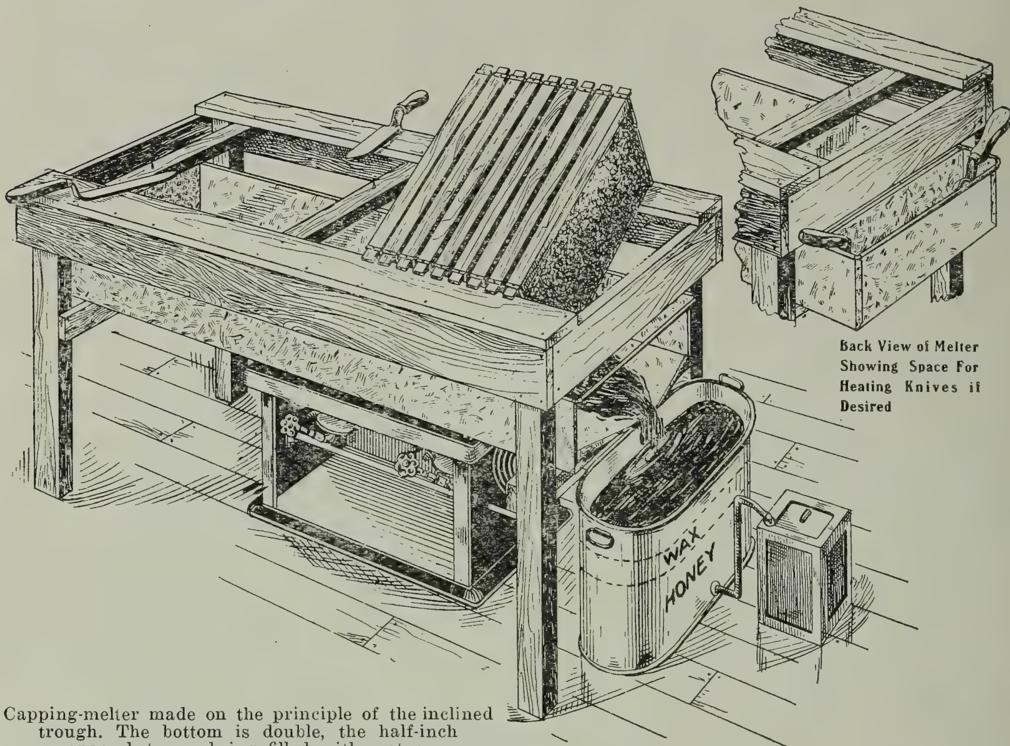
A simple form of capping-melter which consists of a can within a can, the space between being filled with hot water.

to drain out, the cappings themselves being rendered into wax at some later time. In the last few years there has been considerable interest in capping-melters which, briefly speaking, are provided with a hot surface on which the cappings fall as they are cut from the comb which melts the wax, and the melted wax and honey pass over into a separating vessel, together with the pollen, bits of cocoon, and other refuse.

WHEN A CAPPING-MELTER SHOULD BE USED.

It can not be denied that it is a great convenience to have the cappings gotten rid of as fast as the work progresses, for it is hard work to handle cappings that are heavy with honey; and to drain the cappings properly an expensive outfit of tanks, tween the honey that has gone through it and that which has been extracted. It is true that if the honey is allowed to cool under the wax it takes on a waxy flavor which, while not disagreeable, is just pronounced enough to enable one to distinguish it from the rest of the honey. On this account a separator should be used so that the honey may be gotten away from the hot wax as soon as possible.

There are localities where honey in cappings candies in a very short time, sometimes in twenty-four or forty-eight hours, and under these conditions a capping-melter is almost a necessity. This reminds us that whenever it is desired to melt up candied honey or the honey in wax, a cap-



Capping-melter made on the principle of the inclined trough. The bottom is double, the half-inch space between being filled with water.

ping-melter is the very best arrangement to use, as there is practically no danger of scorching the honey and yet the work may be done quickly.

DIFFERENT TYPES OF MELTERS USED.

In general we may say that there are three different types of capping-melters in use, all of which have their good points. The simplest is the hot-water jacketed can, which has a gate at the bottom or suitable tube for an outlet, covered with a screen of large capacity to prevent unmelted cappings from flowing out with the warm honey. This is shown on previous page.

It will be observed that a circular screen as shown at the side rests in the bottom of the inner can, leaving a space all around the outside of the compartment for the escape of melted wax and honey which find their way around to the gate on the lowest side. The box or framework shown sits over the top of the can confining the heat and affording a rest for the combs being uncapped. The box stands a little to one side of the can, exposing a small part of the water-jacket in which the uncapping-knives may be placed in the hot water if desired. This melter is not adapted for use in the largest apiaries, as a single-burner stove furnishes all the heat.

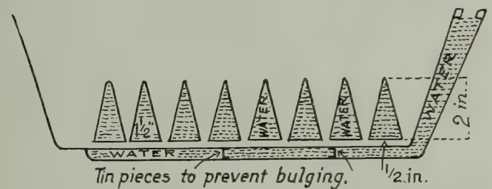
The second form of melter is almost as simple; but owing to its size, two burners may be used so that it answers all requirements in a large apiary where there are two uncappers. It consists of a long trough or pan with a double bottom, the space between the two bottoms for the hot water. The open end of the trough is the lowest, so that the cappings and honey that fall on the heated surface gradually run down; and the wax, by the time it reaches the outlet, is all melted.

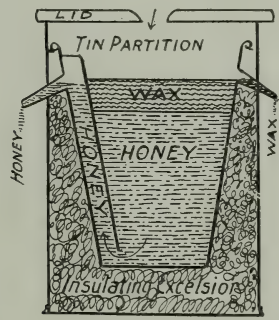
This form of melter where there is room for it makes a very convenient addition to the extracting room, as there is plenty of space for holding the uncapped combs, so that the dripping honey may fall down into the pan and run out into the separator with the rest. At the back of the pan is an opening into the hot water, which is used for adding water or heating knives.

Mr. E. L. Sechrist, of Clarksburg, Cal., uses a modification of this second form of melter which deserves mention. In principle, his outfit is really a McIntyre uncapping box combined with the melter, the cappings falling at first on to a draining

surface, where about three-fourths of the honey drains out. After this they are shoved forward onto the hot surface of the melter where the wax melts and runs over into the separator together with the remaining one-fourth of the honey. There are some kinds of honey that seem to be more easily darkened or scorched than others. With such honey this arrangement would seem to be advisable.

The third type of melter makes use of square or triangular tubes containing hot water, on which the cappings fall from the knife. This form has the advantage that it takes up very little room, as the cappings melt very quickly, so that the exterior dimensions of the pan do not need



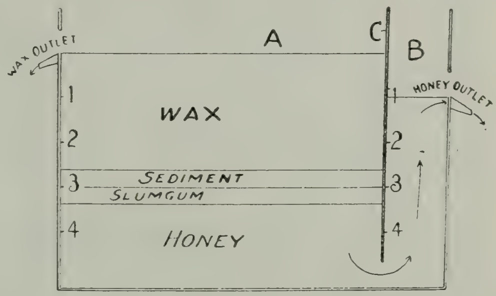


to be very large, owing to the extra surface secured by the use of the tubes. The only disadvantage of this construction is the greater cost and the extra amount of labor required in cleaning as the spaces between the tubes get clogged occasionally with pollen or bits of cocoons.

DISPOSING OF THE MELTED WAX AND HONEY THAT RUNS FROM THE MELTER.

The stream of wax and honey from the melter may be run directly into a pail or can, and as soon as it is full another one put in its place. In a few hours' time the layer of wax on top of the honey will have hardened so that it may be lifted off and the honey poured through the regular strainer together with that from the extractor. This plan is objectionable in that it requires too many cans of hot wax standing around in the way. Furthermore, the honey underneath will take on a taste of the wax to some extent if it is allowed to remain in contact with it until the wax cools. To overcome this difficulty a gate may be provided at the bottom of the can so that the honey may be drawn off at intervals as fast as the can becomes full. Care must be taken to shut the gate before any wax begins to run out. In this way the wax remains permanently in the can until the next day, when it is lifted out before beginning work.

The most convenient plan is to use an Aikin honey and wax separator, a diagram of which is shown herewith. The wax



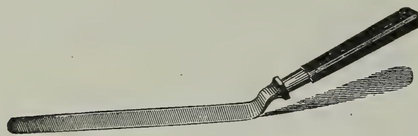
being lighter than honey floats on top and may be drawn off when it reaches a certain level if desired. The honey being heavier settles at the bottom and runs down under the partition and finally out of the honey outlet as indicated.

This separator works well in every way except that the wax has a tendency to chill somewhat, especially if the work stops for a while; and to overcome this we find it advisable to enclose the whole thing in a wooden box, the removable cover of which has a funnel to convey the wax and honey to the can inside. This keeps the wax melted all day, the honey being drawn off constantly through the honey outlet at one end. At night the cover of the box should be removed so that the wax will have a chance to harden. The next morning it may be lifted out a solid cake, which, when the honey has drained off and the refuse scraped from the under side, is ready for market. A small-sized tin wash-boiler with a partition soldered close to one end is just about the right size.

UNCAPPING-KNIVES.

There are two forms of uncapping-knives used. One, the Novice, has a thin flexible blade, made of steel. The other, the Bing-

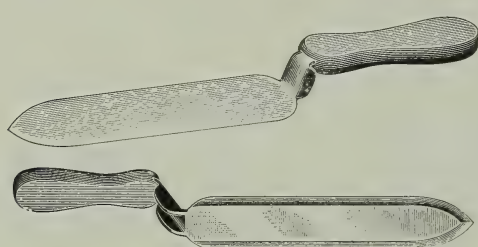
ham, has a thick flat trowel-shaped unyielding blade having edges beveled on the under side. The first mentioned will do uncapping, and is very handy for scraping



The Novice honey-knife.

bottom-boards or removing burr-combs on the inside of the hive. Being thin and flexible it will fit curved surfaces; but for uncapping only it is in no sense to be compared with the Bingham.

An improved form of the Bingham knife is shown in the next illustration. The shank connecting the knife and the blade has circular projections on each side forming a part of the shank, and folded at right angles so as to afford a good solid grip to



Bingham improved uncapping-knife.

the thumb and fore finger. As the blade is on a different plane from the handle, one can get a better grip and a closer one to the blade if he can grasp the shank itself. Experience also shows it is an advantage to have the handle flattened in such a way as to give a good solid hold.

HOW TO USE UNCAPPING-KNIVES.

The blade should have a keen edge and be frequently sharpened to get the best results. Grasp the knife as shown in the

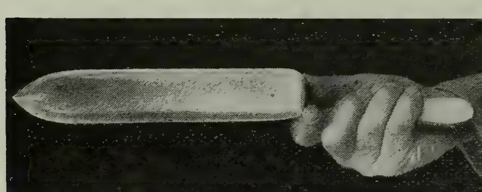
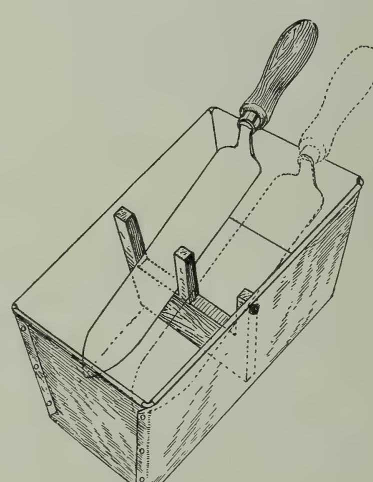


illustration following. Bring the fingers as close to the blade as possible, but not far enough to interfere with the cutting of the cappings. The comb should be placed upon some sort of projection, a nail point supported over the uncapping-box or can. It then should be leaned forward when the knife by a sawing movement begins cutting at the bottom edge. When particles of wax and honey cling to the blade so as to interfere with the work, it should be scraped on a wooden edge of some sort. See illustration on preceding pages, showing Dadant's uncapping-can in use.

Some prefer to work with *hot* knives, and where the honey is very thick there is no question but that they will do faster and nicer work with less strain on the wrist. For this purpose it is customary to use two knives. A sort of bread-pan is made or provided, having a wooden cross-partition as shown in the accompanying sketch. This is filled with water and placed on a single-wick kerosene-stove. The whole outfit should then be placed within easy reach of the uncapping-box, so that the operator can use one knife and then the other as fast as either cools.

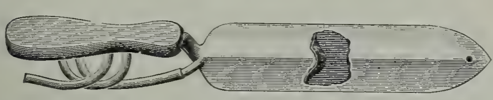
There are some who claim that there is no advantage in using hot knives, but our experience leads us to believe that when honey is very thick, as it often is in some localities, it is economy, both in labor and time, to use them. Indeed, if the combs are new a hot blade is indispensable.



In Europe, and to some extent in this country, uncapping-knives have been kept continuously hot by the use of electricity or of steam. As the former will not be available to most beekeepers located on their ranches, steam has the preference. A thin sheet of copper is soldered on the top

O. B. Metcalfe's way of uncapping with the steam-heated knife. Instead of resting the end-bar of the frame on a nail-point, the projection of the top-bar is set into a one-inch hole in the cross-piece of the uncapping-can.

side of the blade of an ordinary uncapping-knife in such a way as to make a chamber over the entire top surface of the knife.



This chamber should have a small hole at the end for the exit of steam, and a tube at the other to which is attached a quarter-inch rubber hose, three or four feet in length. This is secured to the spout of an ordinary small tin tea-kettle by winding bicycle-tire tape around the tube and the spout until a tight connection is made. A common rag, after the kettle is filled with water, is placed over the opening of the kettle when the cover is crowded into place. This makes almost a tight steam joint, or tight enough for the purpose for which we wish to use it. The kettle is next placed upon a kerosene or gasoline stove, and when the water boils, the knife is ready for use.

In operation a small jet of steam will be forced out from the small orifice at the end of the blade. If a good circulation of steam is provided, the knife can be kept continuously hot, and, while hot, it is to a great extent self-cleaning, as the honey and the cappings will melt off from it about as fast as they accumulate.

Some have tried these steam-heated knives, and say that there is no advantage in using them, as they would prefer to work with a cold keen-edged blade rather than a hot knife with all its attendant heat. The attachment of the tubing somewhat interferes, of course, with the free action of the knife; but for all these objections there are others who feel that a steam-heated uncapping-knife is a long way ahead of the knife heated at intervals in hot water.*

While it is customary with any knife to use the upward stroke, there are some few who prefer the *down* stroke. Experience will have to determine which is the better for the individual user.

SHALL THE COMBS BE SPACED WIDE OR CLOSE FOR UNCAPPING?

The majority of extracted-honey producers space the combs $1\frac{1}{2}$ inches, or $1\frac{3}{4}$ inches from center to center. Hoffman frames can be spaced as wide as this as well as any. The thick combs have more honey to the comb, and, consequently, fewer need be handled.† If the uncapping-knife cuts deep there will be more wax, and wax always has a good market. The thick combs should always be cut down to normal thickness in uncapping before returning them to the bees.

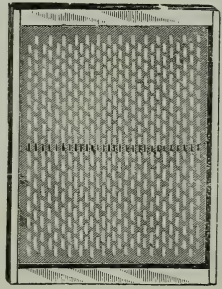
After one day's uncapping, the cappings should drain dry. They should be removed before letting a fresh lot of cappings drop on to them. To get the cappings perfectly dry, some put them in a cheese-cloth bag to hang behind the stove over a pan for a few days. This will do for a small extracting business. Where the business is carried on more extensively, the cappings, after draining for one day, should be put in a wax-press and squeezed dry while cold; or, better yet, they should be melted up as fast as they accumulate. See WAX-PRESS, under WAX.

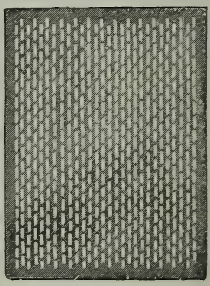
SHALLOW OR FULL-DEPTH EXTRACTING-COMBS

The question is often asked, whether one should use the shallow extracting-frames that are advertised in most of the dealers' catalogs. This depends a good deal on the honey-flow and general conditions. If the frame is as deep as a Quinby, the shallow frame for extracting purposes is almost a matter of necessity, as it is very inconvenient to handle these large combs, both in uncapping and extracting. Shallow combs have the special advantage that bees will enter a super containing them quicker than they will one of full depth. There is not so much room in the shallow supers for them to keep warm at one time: and they will, therefore, fill a set of shallow combs when they would hardly deign to enter an upper story containing full-depth ones. It is a common practice with a good many practical beekeepers to have both shallow and full-depth combs. After the bees are well started to going above, the full-depth supers may be used.

THE QUEEN-EXCLUDER FOR EXTRACTING.

As a general rule, in hives run for extracted honey, the queen will occupy one





or more supers containing extracting-combs, unless she is confined to the brood-nest by means of a queen-excluding honey-board; see DRONES. When one is used, the extracting-combs will contain nothing but honey and perhaps a little pollen, while the brood will be confined where it should be, in the lower story or brood-nest.

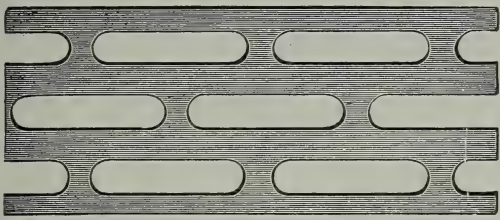
When running for *comb* honey it is usually not necessary to use the excluders.

Some objection has been raised by some to the effect that zinc boards hinder the passage of bees loaded with honey, and that, therefore, they have a tendency to re-

* With some combs the propolis in them bakes on to the hot knife until it is useless. I have one which I made and used in 1896.—A. C. M.

† But the more combs in a super the more surface for bees to stand on when "ripening" nectar, and the better and more rapid the work. See BEE BEHAVIOR.—A. C. M.

strict the amount stored in the supers. This is denied by the great majority of users. However, a few provide an entrance to the upper story or supers, placing the same at the bottom of the first super and above the excluder. This allows the bees in the



Perforated zinc.

super to escape directly into the air, without passing through the honey-board from the brood-nest below and out into the regular entrance. It is argued that this extra entrance to the super saves time and permits incoming bees to go directly into the supers and store the honey without any waste of time.*

In order to catch the bees that are going into the lower entrance, Mr. B. Walker, of Clyde, Ill., has a long wide board connected with the upper entrance and slanting downward at an angle of 45 degrees in front of the lower hive entrance. The incoming bees strike this inclined plane, crawl upward and enter the supers just above the zinc.

The entrance to these supers may be through one or more holes bored near the bottom edge of the super, or the wooden rail at the front end of the honey-board may be left out, so that the bees can pass into the super and above the perforated zinc.

For particulars on how to extract during a dearth of honey without robbers see FEEDING, OUTDOOR.

MANAGING A SERIES OF EXTRACTING-YARDS BY MAKING ONLY FOUR VISITS IN A YEAR.

The general treatment of this subject of extracting would hardly be complete were we to omit mention of the remarkable success attained by Mr. E. D. Townsend, of Remus, Mich., in handling a series of outyards by making only four trips a year to each yard. As he makes no secret of his methods, it may be well to describe them. He believes primarily in strong colonies, and a brood-nest not smaller than ten Langstroth frames. In the fall of the year he makes one trip to feed up and pack in winter cases. Colonies a little short are given enough to furnish them from 25 to 30 lbs. of stores all told. The bees are then left until the first of June following. As his fall visits are made some time in

Walker's plan of using an upper entrance in connection with an alighting-board.

October, there is a period of seven months when no one goes near them.

He says he has practiced fussing with bees in the spring to equalize stores, and reduced the brood-nest to a size that the bees can readily occupy; but colonies so treated have averaged no better than those

* A bee's time is of small consequence, as, from best observations available, it rarely makes more than ten or twelve trips a day when after nectar, and half that number when gathering pollen.—A. C. M.

that had no care whatever. When he next visits them (in June) he gives each of the strong colonies two ten-frame supers of empty extracting-combs; but instead of putting ten combs in a super he puts in eight, spacing them apart equally to fill out the room. The bees are not seen again until he makes a third trip (in July). This is for the purpose of extracting all honey, as he does not wish his basswood mixed with clover. Except for this he would let them go entirely until the end of the season for the final extracting, managing the outyards with only three trips in a year. As it is, he separates his clover from his basswood by making a fourth trip. On his third visit the combs are extracted of all clover, and put back on the hives again. Last of all, he makes one more (a fourth) trip, removes all the filled combs, and extracts them of the basswood. The bees are then left until he puts them away for winter in the fall, which will be the first trip of the next year.

His secret of success lies in the fact that he is a skillful beekeeper and has a large number of drawn combs—enough to give every strong colony two extra supers. The combs being spaced wide apart, eight frames to fill the ten-frame capacity, they are drawn out thick and capped over. As the bees have an abundance of room at all times, there is little or no swarming; and such swarming as there is does not amount to much. In fact, Mr. Townsend argues it does not pay to keep a man at the yard to look after that, for he can buy more bees, if he needs them, at $3.00 a colony, to make up for any losses; and this will be far less cost to him than to keep a man looking after the swarms.

In uncapping he runs the knife deep, planing the combs down to a normal thickness. This gives him a surplus of wax that always finds a good market, and an extra amount of honey in the cappings; but as this drains off he gets all the honey, and finally melts all the cappings up into wax. He thinks bees in the height of the honey-flow are bound to build comb; and if no provision is made they will stick in burr and brace combs; when, if the frames are spaced wide, their natural instincts for comb-building can be satisfied, and the extra depth of comb can be converted into wax, which is as good as cash.

Of course, when he makes his visits to the yards he takes helpers along. Cheap help, with a good manager, can do as much or more work than expensive men without the boss along.

Another fact worth recording is that Mr. Townsend gets two cents above the market for his honey. The fact that it is *left on the hives till after the season* where it *can ripen thoroughly,* gives it a richness and quality that the consumers demand and want more of when they have tasted the first lot.

EXTRACTING-HOUSES.—There are no two extracting-houses alike. Many beekeepers use buildings built for other purposes. Others think it more satisfactory to use a small structure designed especially for the purpose, small enough to move as a whole, or so constructed that it can be taken down in sections, and moved to new pastures whenever the locality "plays out."

Wherever possible, extracting-houses should be placed on elevated ground—that is, on a side hill. In some cases it may be desirable to have the building two-story. If the land lies right the second story should be on a level with the top of the hill where the apiary is located. The combs can then be run directly into the building, and the honey extracted on the floor. A tin pipe connecting the honey-gate can then pass through the floor directly into a receiving-tank in the basement or first story, the floor of which should be on a level with the ground at the bottom of the hill.

In most instances the extracting-house will have to be placed on a slight rise of ground in the beeyard. In that case a tin conducting pipe running 10, 50, or even 100 feet will convey the honey as fast as it runs from the extractor into a receiving-tank at a slightly lower level in the yard. See illustration of Chalon Fowls' and E. W. Alexander's extracting-houses further on.

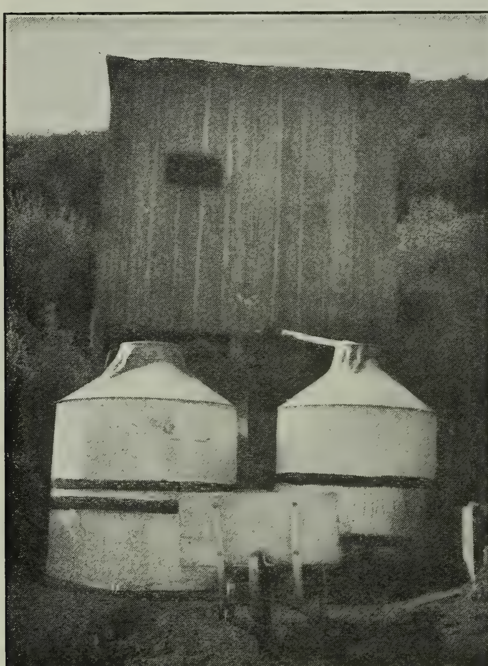
In some other cases the ground will be perfectly level, and it will then be necessary either to locate the extractor on an elevated platform so that the extracted honey can run into some sort of container, or to place it directly on the floor of the house and convey the honey to a point desired, either upstairs or to another portion of the building, by means of a honey-pump

Alexander's extracting-house; putting the combs in. Notice pipe in the rear from the extractor, leading to a tank (not seen) further down the hill.

Alexander's extracting-house; taking the combs out.

illustrated and described a few pages back under the head of EXTRACTING. In any event, the building should be so located as to save steps, and, if possible, to provide an easy exit from the hives to the building.

In California in the mountainous country there is usually no difficulty in putting the extracting-house on a side hill. The Burbank cut shows a sample of some of the little structures in which a large amount of honey is taken, discharging the same by means of a pipe into one or two large galvanized honey-tanks with capacities ranging anywhere from 10 to 20 or even 30 tons. In fact,they are little cisterns above ground.



Honey-tanks on a level lower than extracting tank, near Burbank, Cal.

The late E. W. Alexander, of Delanson, N. Y., one of the most extensive beekeepers in the world, used a small extracting-house that certainly had some features to commend it. It was just large enough to receive a four-frame extractor, a man to operate it, an uncapping-box, and space to receive the fresh combs as they come in and those that go out. The combs were carried in comb-carriers, which were nothing more nor less than hive-bodies rigged up with a convenient iron handle as shown. Mr. Alexander had something like 700 colonies, all in one apiary, and his crops of honey annually went into the carloads. While the carrying boxes may seem very crude, yet, used in the manner in which he used them, in connection with this small building, they give excellent results with a minimum of labor.

Two men took the combs out of the hive, and shook or brushed off the bees. While one was putting in fresh empty combs from which the filled ones had been taken, closing up the hive and opening up another one, the other carried the combs just removed in the carrier to the man in the extracting-house. The sliding door at the right was lifted and the combs, carrier and all, were pushed inside and the door dropped, shutting out all possible robbers. In the same way the empty combs were removed in another carrier from the outer door at the left, and so on the process continued. The quick opening and closing of the slide doors prevented robbers from getting at the work inside. The three men thus working, changing place every now and then to relieve the monotony, were able to take out several thousand pounds of honey in a day. As the ground is very hilly and rough at this yard, a wheelbarrow would be out of the question.

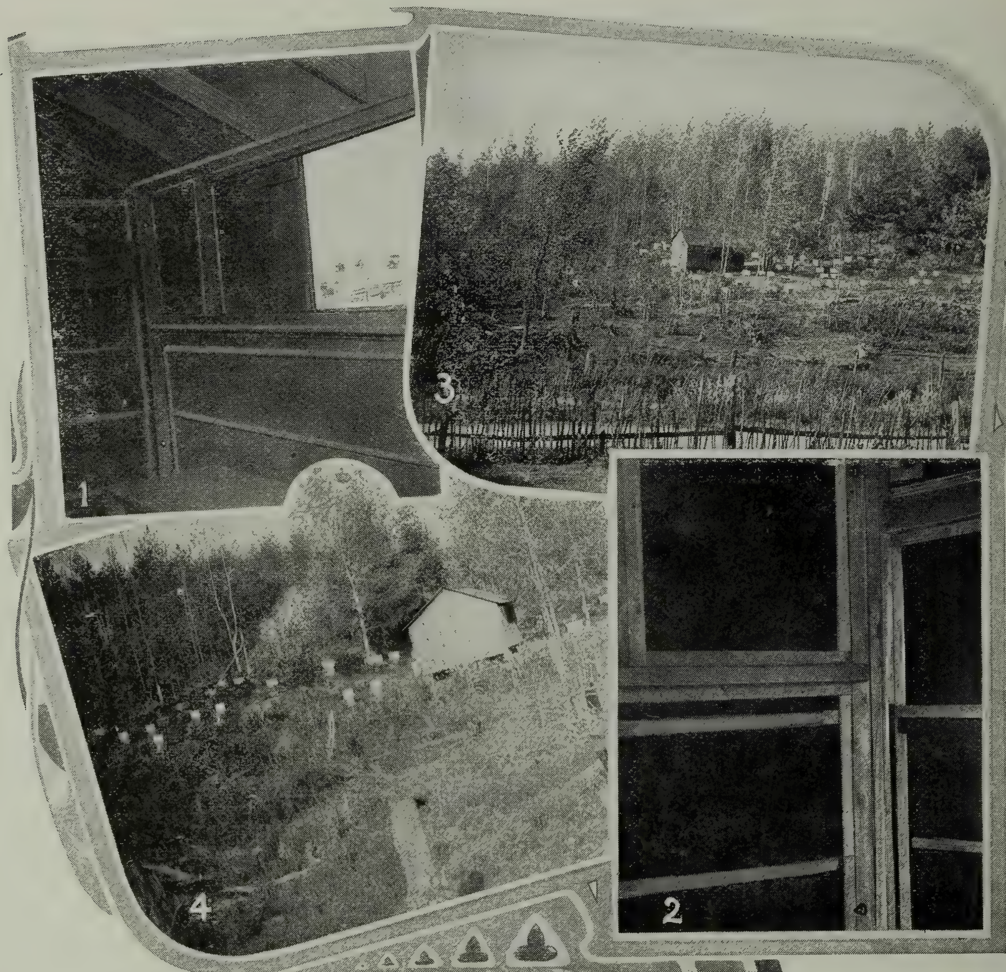
It will be noted that the tin pipe going down through the floor, connecting with the honey-gate (see cuts), passes down through the yard and communicates with a large open honey-tank inside of a small building not shown. The whole arrangement, from start to finish, is unique and perfect for the conditions mentioned.

Where the ground is comparatively level, and no steep grades, a wheelbarrow or handcart, preferably with pneumatic tires, as described a little further along, would, perhaps, be better. Other beekeepers make a very small extracting-house that can be lifted up on wagon-wheels, and carried from one yard to another. It sometimes happens that localities change, and then it becomes desirable to move the extracting-house.

Mr. Chalon Fowls, of Oberlin, O., has his extracting-house located in his back yard. The illustration shows how the tin pipe carries the honey, as fast as it is extracted, from his extractor into a receiving-tank in the basement of his house, about 30 feet away. The only objection to this is that the honey must be, later on,

The pipe used by Chalon Fowls to convey honey from the extracting-room to the settling and straining tank in the basement of the dwelling-house.

Another view of the honey-pipe. The distance is about 40 feet, and the pipe, being made of galvanized iron, cost about $4.00.



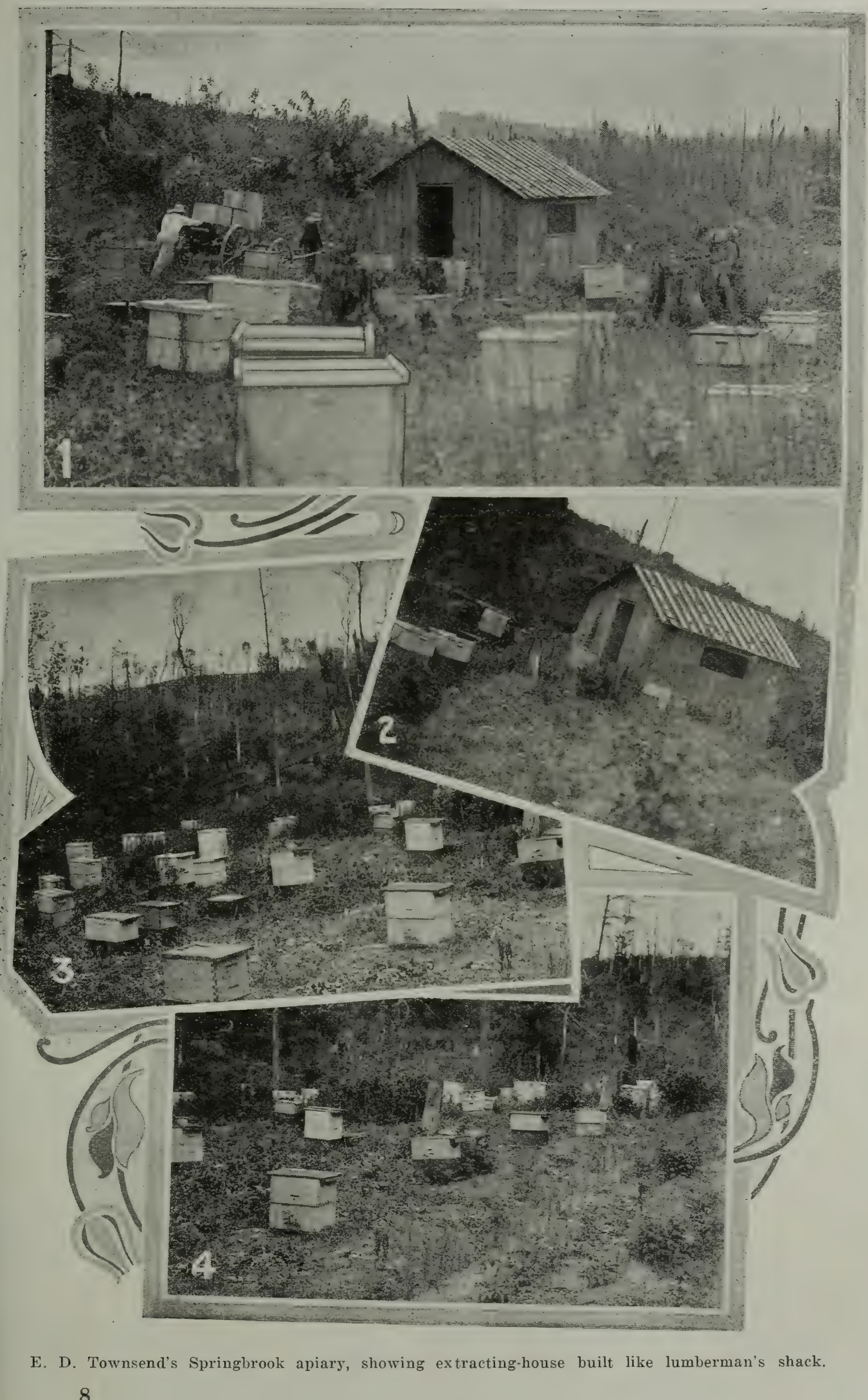
E. D. Townsend's portable extracting-houses and Pine Lake outyard.

carried out of the cellar in square cans or other containers; but it has the great advantage that the honey is disposed of quickly and easily during the rush of the extracting season, and then, later on, when there is more leisure, the honey can be removed from the cellar and loaded on to the wagons.

E. F. Atwater, of Meridian, Idaho, uses a building which he can take down, load on a wagon, and set up at any spot desired.

Mr. E. D. Townsend, of Remus, Mich., as will be seen by the illustration, also uses a building of this sort—that is to say, it is made up of panels, said panels bolted together at the corners. Sliding doors at the sides provide light, ventilation, and, whenever it is deemed necessary, exit for the bees that accumulate inside of the building through escapes. These buildings can be put up in various ways; but in order to make the panels strong enough to hold themselves together after being taken apart, 2x4 scantling should be used. Before putting on the siding it is desirable to use ordinary tarred paper, which is proof against the depredations of mice and insects; and, besides, it provides additional warmth, although that is a minor feature for a building that is used wholly in the summer. But the use of the tarred paper makes the building much more bee-proof, and this is certainly an essential feature in an extracting-house where extracting may have to be carried on after the honey-flow, when bees will be inclined to rob.

The larger illustration on the next page shows the exterior of one of the buildings built on the plan just described, and also the apiary in connection therewith. In one

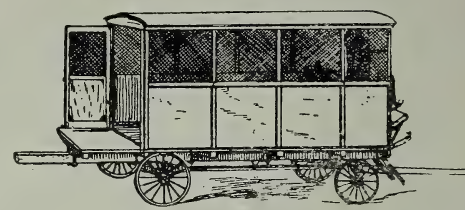


E. D. Townsend's Springbrook apiary, showing extracting-house built like lumberman's shack.

of the illustrations it will be noted how Mr. Townsend pushes his wagonload of honey from the immediate vicinity of the bees and the building, to a point some rods distant where the team is hitched, ready to be connected to the wagon. Our friend believes it is not ordinarily advisable to bring horses into a beeyard if it can be avoided.

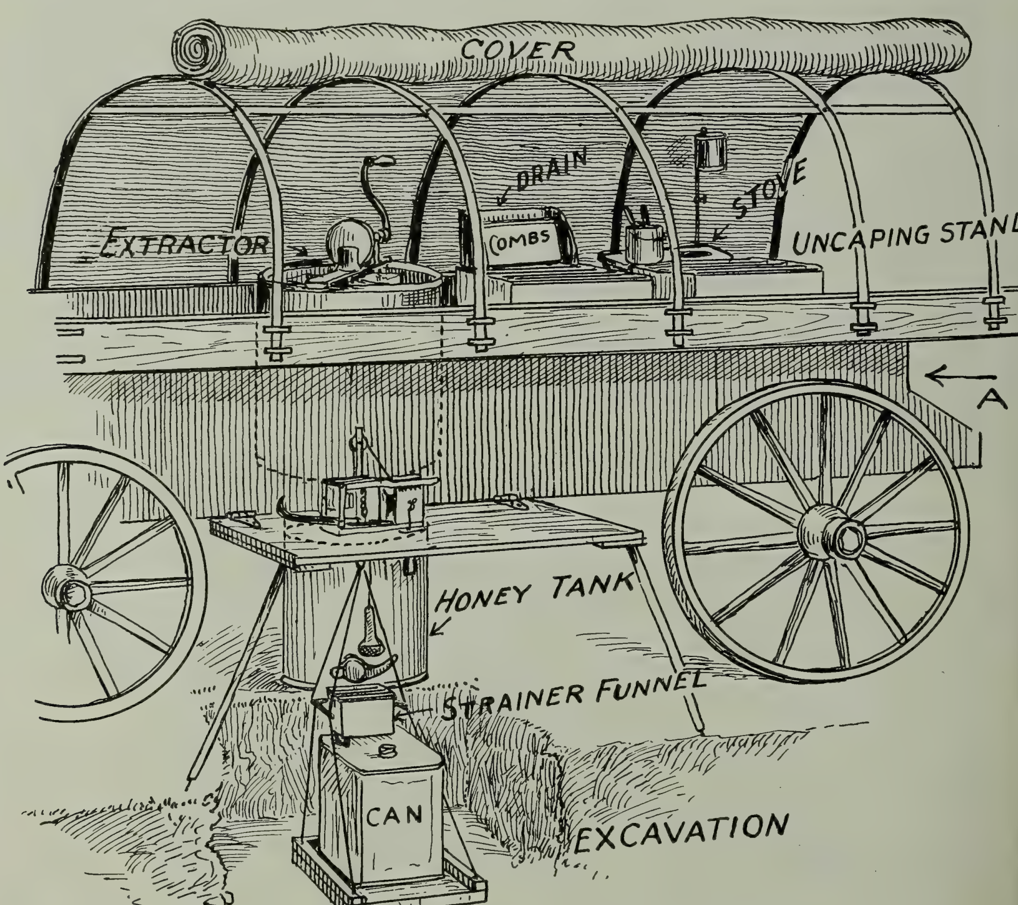
The two other views will give an idea of the raspberry country in Northern Michigan, where one of these cheap takedownable extracting-houses is located. This raspberry country is subject to forest fires; and after a fire it is necessary to move building and apiary to another location. This explains why Mr. Townsend makes his bee houses so that he can take them down, load on to a wagon, and set them up again in another place.

Still others prefer a genuine portable extracting-house—that is, a house permanently on wheels, such as the one shown in the next illustration, used by W. D. Jefferson, of Safford, Arizona. Low wide-tired iron wheels are used, and a platform wide enough to extend out over and even with the outer edges of the wheels, and long enough to give sufficient room for extracting purposes, is mounted just high enough

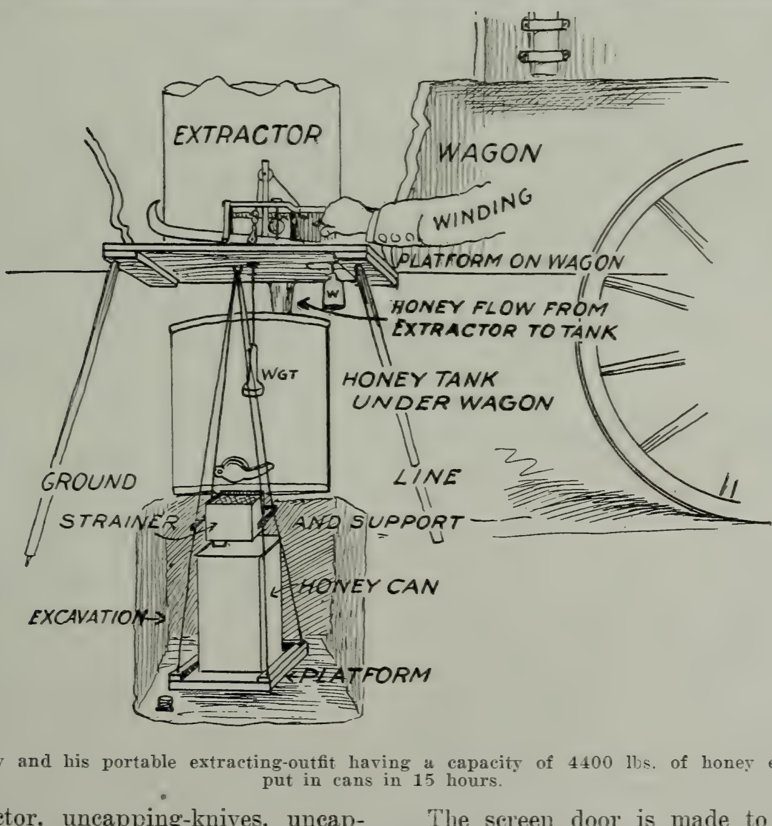


Jefferson's portable house.

to clear the wheels. Beneath the platform is a shallow galvanized tank, hanging between the front and rear axle-trees, that will hold 200 gallons. On the top of it is built a light skeleton-like structure, the upper portion of which is screened with wire cloth. This house on wheels is equipped



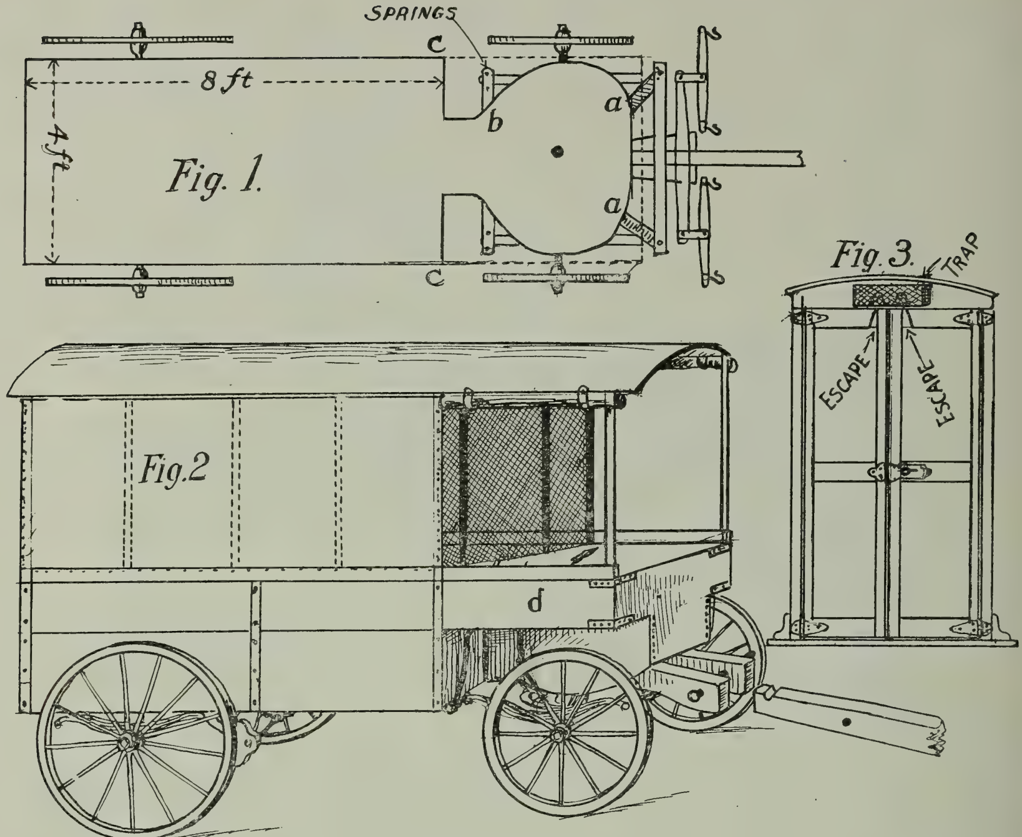
The Ensley portable extracting outfit.



R. W. Ensley and his portable extracting-outfit having a capacity of 4400 lbs. of honey extracted and put in cans in 15 hours.

with extractor, uncapping-knives, uncapping-tank, and all. The extractor is placed just over the tank; and as fast as the honey is thrown out it runs down into it.

The screen door is made to open outward, and the building is provided with Porter bee-escapes. The structure is large enough to take care of an ordinary day's



Aiken's honey-wagon.

extracting; but to provide for emergency, another wagon has a tank holding 200 gallons mounted low so that the honey can run from the tank of the extracting-house into another tank. This extracting-wagon is drawn from yard to yard; and the honey, as fast as taken, is hauled home, leaving none at the yards where thieves can molest. On the whole, the Jefferson outfit has many features to recommend it; and in some localities, where roads are reasonably good, but where light-fingered people exist, it is the kind of an outfit to use.

Another very simple and cheap portable extracting-house is the one used by R. W. Ensley, of Cory, Col. With an outfit of this kind Mr. Ensley has taken as high as 4500 lbs. of honey in 15 hours. It, like the Jefferson wagon, can be used at any outyard, making it necessary to use only one extracting-outfit for all the yards. This cuts down somewhat the initial investment —a factor that must always be taken into consideration.

Mr. R. C. Aikin, of Loveland, Col., one of the most extensive honey-producers in the United States, makes use of a similar wagon, but more elaborate in its general construction, and, we should say, a better outfit. Its general construction will be made plain by the illustration.

EYE, COMPOUND.—An examination of the large compound eyes of a bee will show that the outside is made of hexagonal areas, thousands in number. Each of these hexagons is the outside of one of the elements of which the compound eye is composed; and, since they are all constructed alike, a description of one will serve for all. Each of these elements is called an ommatidium. If, then, we take a section through one of the compound eyes parallel with the top of the head of the bee we shall get some of them cut lengthwise, thereby showing best the structure, although it is also necessary to cut other sections at right angles to this plane in order to get the shape of some of the parts.

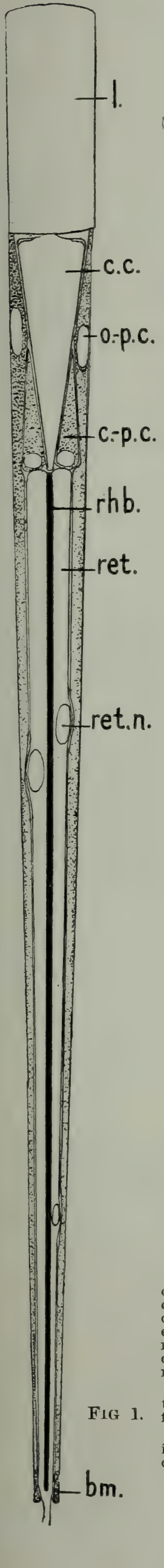


FIG 1.

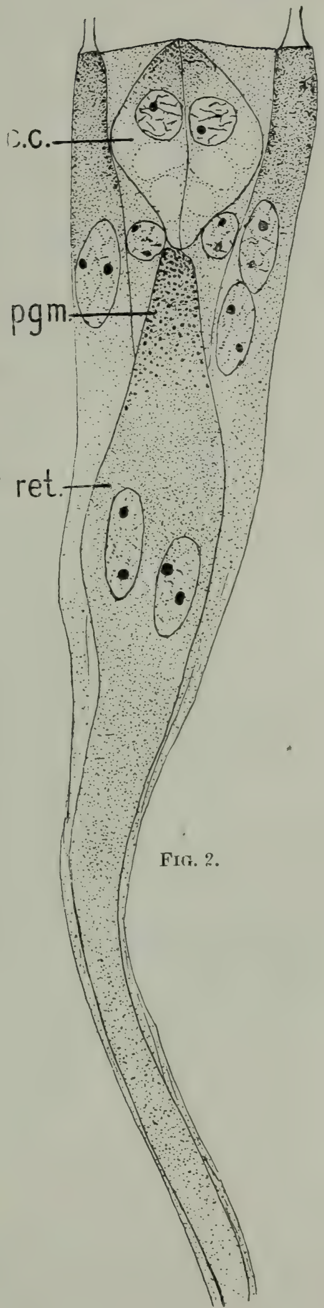


FIG. 2.

FIG. 1. Ommatidium of adult eye of bee: l. lens: c. c., crystalline cone; o. p. c.. outer pigment-cells; c. p. c., corneal pigment cells. which, in the early stages, secrete the lens: r. h. b., rhabdome; ret.. retinula; ret. n., nuclei of retinula cells; b. m., basement membrane.

FIG. 2.—Ommatidium of pupa; lettering as in Fig. 1: p. g. m.. pigment forming in retinula.

In Fig. 1 the pigment is not shown in the center portion of the retinula cells.

The figures which accompany this show the ommatidium cut lengthwise. Another figure shows an ommatidium from the *pupa* stage.

The outside portion, already mentioned, is the lens layer *l,* and is composed of chitin, as is all the rest of the outside covering of the bee. The section shows this cut open, so that only two sides of the hexagon are shown.

The next lower structure is the crystalline cone *c, c,* which is composed of four cells, of which only two show in the long section. In the pupa stage the boundaries are much clearer, and the nuclei larger than they are in the adult eye. This cone is clear, and, like the lens above it, gathers in the light rays so that they can act on the nerves below just as the lens in the human eye gathers together rays of light so they can affect the nerves behind it.

Directly in line with the cone is a long rodlike structure which runs clear to the bottom of the ommatidium, called the "rhabdome," *rhb.* This probably contains the end of the nerves, which are sensitive to light.

Around the rhabdome are eight retina cells *ret,* which have poured out a secretion while in the pupa state to form the rhabdome.

Around the cone and retina cells there are pigment cells *o. p. c. and c. p. c.,* that keep the light from passing from one ommatidium to the other, and thus making a confused image, just as the inside of a camera is painted black to avoid reflections. In the human eye we also find pigment, which is also located just behind the nerve-endings, and answers the same purpose. There are two kinds of these pigment-cells. The ones at the base of the cone, *o. p. c.,* are two in number, and do not extend below the base of the cone. The other pigment cells, *c. p. c.,* extend from the lens to the base of the ommatidium, and are generally twelve in number. The pigment in these cells is located principally at the outer portion of the eye; and the retina cells also contain a pigment, thus making a complete sheath of pigment around the nerve and nerve-endings in the middle.

The nerve lines in the eye extend down along the eight retina cells, and at the bottom come together, and the united nerve extends toward the brain.

F

FEEDING AND FEEDERS.—Feeding is practiced for one of two purposes—to stimulate brood-rearing at times of the year when no honey is coming in from natural sources, or to supply food to colonies that are short at the approach of winter. Whenever possible, feeding should be avoided; for at best it is a messy job, expensive, and, in the case of the beginner, liable to cause robbing. In a good locality it may be possible to avoid feeding altogether. Especially would this be true in those places where there is plenty of buckwheat or fall flowers. To buy sugar by the barrel every fall is very expensive, and the beekeeper should lay his plans to avoid it as far as possible. In many cases fall feeding is made necessary by extracting too close, in some cases even from the brood-nest. This is bad practice and decidedly poor economy. But there are times when it is necessary to give the bees food either to keep up and stimulate brood-rearing or to prevent actual starvation.

When the honey already in the hives at autumn is of good quality, and nicely sealed, it would be folly to extract it, put it on the market, buy sugar, make syrup, and feed it to the bees. There would be very little gained by it, even if the honey sold at a higher price, and the sugar syrup were cheaper. Where the natural stores are dark, of poor quality, or bad honey-dew, it might be advisable to extract and put in their place sugar syrup. Yet of late years it has been our practice to let the bees have every thing of their own gathering, provided it is nicely ripened and sealed in the comb, no matter what the source; and it is very seldom we lose bees in outdoor wintering by reason of poor food.

Of course, sugar syrup is better than some honey that the bees gather; and, pound for pound, it will go further in the hive as food. Some experiments were made a few years ago which went to show that of those colonies fed on honey, the average consumption in winter was from 14 to 18 lbs., while those fed on sugar syrup consumed from 1 to 7 lbs. The inference drawn was that, while the pound of honey had less strength than the pound of sugar, it was more stimulating, causing the bees to consume more of it. But in all probability this experiment showed too great a difference in favor of the sugar syrup. Under ordinary conditions, when the honey is of first quality as, for instance, clover or basswood, there would not be any thing like this difference.

The difference in cost between a first quality of extracted honey and sugar syrup when sealed in the comb is so little that, if we had combs of good natural stores, rather than extract them we would set them aside, and then in the fall give these combs to such colonies as had an insufficient supply. But in any case we would not use all such combs, because, during midwinter, it is sometimes very handy to have them ready, as they can be placed right down in the center of a brood-nest of a colony, for the simple reason that it is impracticable to give liquid food to bees during midwinter. If combs of sealed stores are not to be had, we would give cakes of candy, as described under CANDY elsewhere.

WHAT TO FEED.

It is bad policy to feed any form of sweet that is cheaper than any of the very best granulated-sugar syrups. There are certain grades of molasses and sorghum that may be used; but they have not the heat-producing power of syrup from granulated sugar, and bees have to consume more to maintain the normal cluster temperature. (In winter—November to February—about 70 degrees F., it slowly rises as brood-rearing increases.) It seems to be generally agreed that, dollar for dollar, granulated sugar, when converted into first-class syrup, is as cheap a food for the bees as can be had; and not only cheap, but

comparatively safe. Unbleached West India crystallized cane sugar of a pale straw color is said to be excellent—but we do not find it as good, nor any cheaper.

HOW TO MAKE THE SYRUP.

Something will depend on whether the bees are to be fed for the purpose of inducing brood-rearing or to give a supply for winter. For stimulating, a syrup made of one part of sugar to one of water by bulk is about right. If the water is hot the sugar will dissolve more readily. For a winter food given early in the fall the proportion should be about two parts of sugar to one of water. For late feeding, just before cold weather comes on, the ratio should be about two and a half to one. When made as thick as this the syrup is liable to go back to sugar to some extent, and sometimes it is necessary to put in about a teaspoonful of tartaric acid to every 20 lbs. of sugar. Others find it better to use honey. The proportion then of honey will be about one-third by bulk of the amount of water used. In our own practice we have never found it necessary to use either honey or acid.

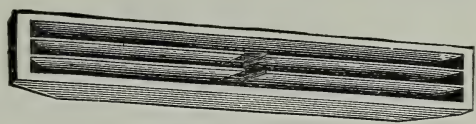
A syrup made by mixing sugar and water in equal parts does not necessarily require heat. The water may be poured into a receptacle cold, and sugar stirred in until the volume of the sugar equals that of the water. The stirring will have to be continued until the sugar is dissolved. If there is any quantity to be mixed in that way, an ordinary honey-extractor serves as a very excellent agitator. The machine is filled nearly half full of water, when the sugar is stirred in little by little while the reel is being turned. It will have to be revolved until the sugar is all dissolved. After a vigorous turning of the crank, even after the sugar is thoroughly mixed, there will be a number of small air-bubbles. These will all disappear if the syrup is allowed to stand for a while. When the proportion of the sugar is two to one or two and a half to one, it is advisable to use hot or boiling water.

Syrup can be mixed in a common wash-boiler where heat is employed. In that case the boiler is put on the stove and filled with the requisite quantity of water. After it has come to a boil, the sugar is slowly stirred in, a little at a time. While on the stove the mixture *must be kept thoroughly stirred* to prevent the undissolved sugar from settling on the bottom and burning. Care should be taken about that, because burnt sugar or syrup is liable to be fatal to the bees.

In many cases syrup has to be prepared at the outyard. Or perhaps the good wife objects to having her stove messed up. While an oil or gasoline stove will heat the water, either one is very slow. The Hutchinson brothers use and recommend a good-sized common galvanized wash-tub, such as can be obtained at any hardware store at a comparatively low price. This is placed on four or five stones of suitable size outdoors when the right proportion of water is poured into the tub. A fire is then built under, and when the water comes to a boil the granulated sugar is slowly stirred in. After it is all dissolved, the fire should be scraped out from under the tub to prevent overheating or burning. This work should be done on a cool or rainy day when the bees are not flying; otherwise one would have a mess of robbing on his hands.

FEEDERS.

There have been hundreds of feeders invented and put on the market. Some of them are very complicated, and the more so the less useful. If one desires to keep

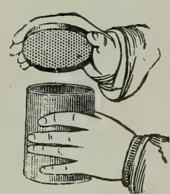


Simplicity feeder.

down his investment he may use common tin pans. These can be placed in the upper story of the hive, and filled with syrup. On top of the syrup should be laid a strip of cheese-cloth that has been dampened in water. The bees will crawl up on the cloth, and appropriate the syrup, without danger of drowning. One objection to pans is that it litters them up; and after the feed is all taken, the cloth is likely to be stuck down by the dried crystals. Boiling water will, however, very soon clean them.

A feeder that has been used very largely is the Simplicity trough feeder. It is an excellent feeder, cheap in price, and occupies very little room on top of the brood-frames.

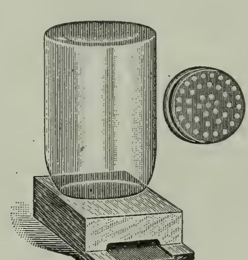
Another feeder that has been used very largely consists of a common wooden butter-dish, such as one gets at the grocery when he buys butter. A hundred of these can be nested together so as to take up but very little room, and the price is insignificant. It is not necessary to use cheesecloth with the butter-dish. Set it on the top of the frames, and fill it with syrup.



Pepper-box feeder.

Another feeder is the pepper-box. It is a can, of pint or quart size, with a perforated top. This is filled with syrup, inverted, and set right over the brood-frames in the upper story.

Still another feeder is the Boardman. This makes use of a Mason jar—something that is a common commodity in every household. The jars are filled with syrup; and with the special cap that is furnished by the manufacturers of bee-keepers' sup-



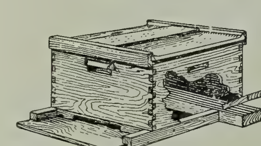
Boardman entrance feeder.

plies one can feed a large number of colonies with a supply of these jars at once. The cans themselves when inverted are set down through a hole in a sort of box. The two side pieces of this box are made in such a way as to leave projections which extend clear into the entrance, thus barring robbers from dodging into the box. The top of the box has a hole just large enough to let the Mason jar be supported $\frac{1}{4}$ inch from the inside of the bottom. When one has a supply of Mason jars, all he requires from his manufacturer will be the box and a special cap that permits the bees to get the syrup in small quantities at a time. As this is an entrance feeder it is always in sight, and one can see at a glance whether the jars are empty or not.

A wheelbarrowful of filled cans with the special caps may be run through the apiary; and whenever a can is discovered that is empty, it is taken out of its box and replaced by another jar filled with syrup. The special feature of this feeder is that one can see by a glance at a row of hives those colonies that have emptied their cans, and a fresh supply given without disturbing the bees or opening the hives. But there is one objection—it has a tendency to incite robbing; yet where one is careful, and sees that the caps to the cans are properly adjusted, there will be little or no trouble.

ALEXANDER FEEDER.

The Alexander is another outdoor feeder that is very popular with many beekeepers. It is nothing more nor less than a trough feeder on the principle of the Simplicity, previously described, secured under the back end of the hive when the bottom-board is shoved forward as shown. To



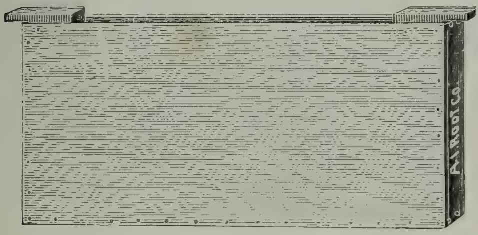
Alexander feeder.

feed, it is only necessary to lift up the block with one hand and pour in the syrup. So convenient is it that a hundred colonies can be fed up in a few minutes. No robbers can molest, for the food is clear back away from the entrance. For stimulative purposes this is one of the best feeders sold. The only objection is that it is sometimes difficult, owing to the unevenness of the ground, to adjust the feeder to the back end of the hive in such a way that it will fit up tight to the hive, shutting out all robbers.

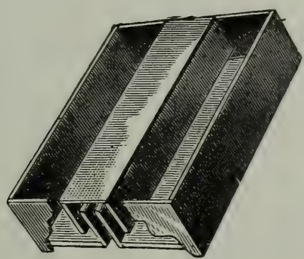
DOOLITTLE DIVISION-BOARD FEEDER.

The illustration given below shows that it is nothing more nor less than a large brood-frame paneled on each side. Down through the center runs a partition reaching almost to the bottom. This feeder, from the very nature of its construction, can be set down in the brood-nest like an ordinary division-board, or brood-frame,

for that matter; and as it is confined wholly within the brood-nest, not even requiring an upper story or super, during the late fall or early spring, when it would be too cool for the bees to take feed from an entrance feeder, the Doolittle is excellent.



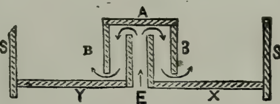
There is still another feeder, and a very excellent one, and that is the Miller. We use it almost exclusively for feeding up colonies for winter. This has a large capacity, and one can feed from 10 to 25 pounds at one time. When for any reason feeding has been deferred till late, this feeder is the one to use. The small feeders before



Miller feeder.

described are adapted to stimulative purposes, and will hold only a couple of quarts at most; but we use only the Miller feeder when we may desire to feed a large amount of syrup at once.

The accompanying cross-section shows that there are two feed-reservoirs. On the principle that liquids always seek their level, the syrup passes under the raised



partition B; and the bees, to get access to the syrup, start from the arrow E, and take the feed from the inner chambers under the cover-board A. With most feeders of the kind, bees are obliged to pass through the two ends or the outside, and sometimes, in cool weather, refusing to leave the center of the brood-nest, they fail to take the syrup. The great feature of the Miller feeder is that the passageway to the feed is located directly *over the center* of the brood-nest, and the warmth of the cluster rising is confined in the passageways and chambers under A. This feature, coupled with the fact that it is made of wood, renders it possible to feed bees during quite cold freezing weather.

FEEDING TO STIMULATE BROOD-REARING.

As previously intimated, feeding to stimulate brood-rearing is a very different proposition from feeding to supply the bees with the necessary winter stores. In the case of the former, our desire is to get as large a force of *bees* (not stores) for the approaching harvest or the approaching winter, the method of procedure being the same in either case. To stimulate brood-rearing, we will feed approximately half a pint of syrup daily; but if we give that amount in an ordinary open feeder, such as the Simplicity, Doolittle, or Alexander, the bees will take it all up in about an hour's time. The result, if the syrup is given in the morning or during even the middle hours of the day, is to excite the colony unduly. Bees will rush out into the open air to ascertain where the sudden supply of food may be obtained. If a whole apiary is fed in this way, there is a general uproar of excitement, often followed by robbing of some of the weaker colonies and nuclei, for the bees in the field will pry into every thing. An entrance unguarded is immediately attacked; and unless there is sufficient force to repel the onslaught, robbing will get so far under way that it may result in the robbing-out of the attacked colony. But this is not all. When the supply of syrup in the feeders fails, bees are apt to be cross, sometimes attacking passers-by or stock in the fields. This is particularly so if robbing gets under way. For these reasons it is usually advised to feed toward night.

Happily we are able to avoid all this trouble by using a feeder that will make a quart or a pint of syrup last during the entire twenty-four hours of the day. In the case of a nucleus, the amount can be so regulated as to last thirty-six or forty-eight hours.

When the supply of food comes in very slowly, about as it would come in from a very moderate honey flow, enough to give the bees and queen encouragement to keep up brood-rearing, they will rear more brood than if the supply is intermittent. All excitement—that is, uproar in the air—as well as robbing is avoided. It is impossible to fix the Simplicity, Alexander, and Doolittle feeders so that they will not give out the syrup too fast; but we can regulate the pepper-box and Boardman entrance feeders. This is accomplished by soldering up all the holes or perforations except one or two. Any tinsmith can do this with a soldering-iron in a very short time. The feeders are then filled with syrup and given to the colonies.*

For outyard feeding this slow feeding is a great convenience, because one can give his bees a supply of food to keep up the normal functions of the colony that will last for three or four days. A strong colony will require more openings than a weak one; and in all cases syrup for stimulating should be in the proportion of about 66 per cent water and 33 per cent sugar, thoroughly stirred until the sugar is dissolved.

Perhaps the reader does not own any pepper-box or Boardman feeders, and yet would like to practice slow feeding as herein directed. All he needs to do is to procure a quantity of self-sealing tin cans that can be readily obtained at the ordinary grocery. In lieu of any thing better, ordinary jelly-tumblers may be used, although these latter are not as good as the self-sealing cans. Through the top of either, punch a hole just large enough to admit a common pin. If this hole does not prove to be large enough to let out sufficient food, two holes may be used, or even three, depending upon the size of the colony. The can should then be filled with syrup, when the top is pushed firmly in place. In the case of jelly-tumblers, it may be necessary to use paraffine paper to make it tight-sealing, otherwise the syrup will leak out too fast; but when paraffine paper is used, care should be taken to cut a hole in the center through which the syrup may pass to the pinhole opening in the tin top.

Experiments conducted during the summer of 1911 showed that this scheme of slow feeding will raise more brood for the sugar used than where the same amount is given intermittently in the open feeders like the Simplicity, Alexander, and the Doolittle. For our work, we prefer the Boardman entrance feeders because we can see at a glance through the glass when the syrup has been used up. If the supply has been taken, it is very easy to put a filled can in the place of the empty without disturbing the hive or the bees.

Where one desires to feed rapidly, in small doses, the Simplicity, Alexander, or the Doolittle feeders are better than the one-hole feeders referred to; but one can use the Boardman feeders by having an extra supply of tops with the full number of perforations.

FALL FEEDING: FULL DETAILS ON HOW TO DO THE WORK RAPIDLY AND EASILY.

If colonies are to be wintered on sugar syrup mainly, the general practice is to feed some time in September, and, as a rule, this is, perhaps, the best time to feed. Still, in many localities in central United States, there is warm weather in October sufficient to start brood-rearing, and much of the stores fed in September may be consumed so that what is left is not sufficient to last until the new honey-flow. For this reason it is often unsafe to feed in September and give no further attention to the bees. There are other cases when, for one reason or another, feeding may be delayed until cold weather begins; for instance, if one is running a number of outyards it is impossible, without hiring a large force of men, to feed all these yards at once, and by the time the last yard is reached it may be rather late.

But before we begin the actual work of feeding we make a preliminary canvass of the whole apiary. This we do by "hefting" each hive; that is, we lift up either the front or back of the hive. A little practice will enable one to determine approximately the amount of stores in each hive, provided there is not too large a force of bees. In that event, we must allow for a corresponding increase. As we go over each hive we mark on the cover with a piece of chalk the

* Boardman feeders can now be purchased of the dealers that permit of any number of holes by the mere turning of a button. This makes it possible to regulate the flow of feed to fit the size of the colony.

number of pounds that will be required. If the colony is a strong one we allow for a total of 25 lbs. if it is to be wintered outdoors; for indoors, about two-thirds that. We aim to have each colony strong enough so that it will require an average of about 20 lbs. each for outdoor wintering. After all the hives are marked up we proceed to the actual work of feeding.

For this late fall feeding we know of no better feeder than the Miller. This will hold at least 25 lbs. of feed at a time, and it can be quickly put on and taken off without much disturbance to the brood-nest. On the other hand, if the colonies are not quite as strong as they should be, so that some contraction is necessary in the winter any way, it is probably just as well, and perhaps even better, to use the Doolittle division-board feeder holding about 6 lbs. of thick feed at a time. During the season, any combs which are found that are too old, or which, for some reason or other, are not perfect, whether due to drone-cells or irregularities, can be gradually pushed to the outside of the brood-frames; then in the fall, when it is time to put in the feeder, provided the division-board feeders are used, these defective combs can be very easily taken out to be melted up later, and with no loss of brood. Furthermore, if the colonies need feeding, these outside combs will not contain much honey. On a cool day an out-yard can be looked over very quickly, and the old combs that are on the outside of the brood-nest removed with very little trouble. If a follower is used, the removal of one comb and the follower makes room for the feeder; but if the combs completely fill the hives, two combs must be removed.

The best time of day for putting feed into the feeder is toward the close of the afternoon. It is not advisable to do the work in the morning or early in the day, for the reason that the bees are always excited, and robbing might be started, especially if it were warm enough for the bees to fly. Right here is a point in favor of the chilly-weather feeding, for there is no such danger of robbing, of course, when the bees can not fly on account of the cool temperature.

We fix the feed at home and carry it to the yards in the regular five-gallon honey-cans, as these are about the largest-sized cans that can be handled conveniently by one person. If two were doing the feeding a larger can might be used.

While the syrup is still hot we load it into the wagon, six or eight cans at a time, and carry it rapidly to the yard. When we reach the edge of the apiary, we take the cans, one at a time, and locate them through the yard where the markings on the hives show that we shall need them. If the cans have good strong handles we are able to carry two at a time, one in each hand; but the difficulty is that the handles are liable to tear loose from the can at one end and drag through the hand, cutting the fingers and allowing the heavy can to fall on the feet. For this reason we prefer to carry one can at a time in the arms. If a small rope sling were used, two cans could be carried without danger.

When we are ready to commence feeding we fill a large sprinkling-can, with the rose removed, and then proceed at once to pour the syrup into the division-board feeders in every hive. Each feeder, as mentioned before, will hold about six pounds of thick syrup. By the time we have emptied one of the five-gallon cans we have reached a point in the yard where a new full one is waiting for us and we can proceed without stopping to run for more cans. On the covers of the hives are marked the number of pounds of syrup which each hive is to receive. It is likely that not all of the hives will need feeding a second time, so the second day the work can be done even more quickly than the first time. When it is not too cool the bees will have taken the syrup in one feeder in 24 hours' time; but if the weather is very cold they will require 48 hours; but this time can be materially reduced if the syrup is given hot. We would always give it hot if it is cold enough so that the cluster is contracted. After all the hives have been fed up we go over the hives again, this time making a careful examination of the brood-nest. If more syrup still is required we mark the hive again and later on feed it and all others that may be short.

FEEDING IN FREEZING WEATHER.

Though colonies have been wintered well when fed after cold or freezing weather, we think much the safer plan is to have it all done during fall not later than October,

for the northern States, that they may have the syrup ripened and entirely sealed. If the weather is not too cold you can feed with the Miller feeder as previously intimated. If you have been so careless as to have bees that are in need of stores, at the beginning of winter, we would advise frames of sealed honey if you can get them; and if you can not, use candy. See CANDY.

If the syrup is covered up with warm cushions or something equivalent, it may be fed at any time, although it does not seem to be as satisfactory under all circumstances as stores sealed up in their combs.

When feeding in cool or cold weather, you are very apt to uncover the cluster, or leave openings that will permit the warmth of the cluster to pass off. We have several times had colonies die in the spring after commencing feeding, and we imagined it was from this cause alone. When they first commence raising brood in the spring, they need to be packed up closely and snugly. Making a hole in the quilt or cushions above the cluster, and placing the feeder over this so as to close it completely, does very well, but is not, after all, as safe as giving the feed from below. For feeding in early spring, especially where the colony is weak, we would prefer candy or well-filled combs of sealed stores.

FEEDING IN THE SPRING, OR FEEDING ENOUGH IN THE FALL TO LAST TILL THE NEXT HONEY-FLOW.

Some years ago it was the general practice to feed in the spring to stimulate brood-rearing, such feeding taking place as soon as settled warm weather came on. The purpose of this was to get a large force of young bees for the harvest when it came; but in later years the tendency on the part of our best beekeepers has been toward feeding copiously in the fall enough to last not only all winter but during the spring and until the honey-flow. Experience seems to show that spring feeding very often does more harm than good by over-stimulation. Brood is expanded beyond the capacity of the bees to hover and keep warm. Robbing is often induced. Beginners especially are apt to overdo it; and even a veteran will sometimes get his colonies so strong before an extra supply of nectar comes in, that swarming will be brought on prematurely.

This question of feeding heavily in the fall to last until the next honey-flow the following year, or feeding moderately in the fall and stimulating the following spring, depends somewhat on the locality, and very largely on the man himself. Many beekeepers of experience, especially in some localities, can doubtless practice spring feeding to advantage; but as a rule beginners will do better to give all their colonies enough in the fall so that they will have about 25 lbs. of sealed stores about the time cold weather begins to come on. In most of the northern States this will be about the first or middle of November. In our more northern States and in Canada the stores should be sealed about the first of October.

WHEN ROBBERS ARE BAD, FEEDING AT NIGHT.

During the early fall of 1887 we found our apiary almost on the verge of starvation, the previous summer having been very dry. Robbers were unusually vigilant, and it was almost impossible to perform any manipulation with the hives without getting a perfect storm of robbers in the brood-nest. Feeding during the day was out of the question, and yet the colonies must be fed in order to prepare them for winter. Accordingly, to circumvent the robbers we fed at night by the light of lanterns. Contrary to what we might expect, the bees gave us but very little trouble by flying against the lanterns. As the bees took up all the feed in the feeders during the night, and the robbers had had no opportunity to investigate during the feeding, every thing was comparatively quiet the next morning and also during the following day. We fed very successfully in this way some three or four barrels of sugar. Although we have recommended feeding *toward* night, in the preceding paragraphs, in the case above mentioned we fed from about 7 P. M. in some cases until 10:30 P. M. Perhaps we should also remark, that, if it is inconvenient to work at night, feed on the first rainy day. Put on your rubber hat, coat, and rubber boots. As long as it rains, bees will not bother you. Rain does not interfere with work as much as one might imagine.

For particulars regarding feeding back to fill out sections, see FEEDING BACK.

FEEDING BACK.—This subject is one interesting a large number of beekeepers in the comb-honey class, the main object, perhaps, being to prevent unfinished sections. At the same time much can be done toward preventing swarming as well, if the sections are removed from the colonies before they are capped and finished up after the danger of swarming is over by the feeding-back process, for it is well known that a great amount of capped honey in the hives is very conducive to swarming.

Many who attempt to feed back, fail on account of the many difficulties encountered. Mr. J. E. Hand, of Birmingham, Ohio, has made a throrough study of this subject, and he finds that, while the work can be profitably done, much attention must be given to the details, since there are many things to take into consideration.

He finds it more practicable to use a feeder in which the honey can be given below the brood-chamber instead of on top, as this is the more natural way for the bees, and they take it more readily. The Quinby feeder has a tin tray, 2 inches deep, enclosed by a wooden frame of the same depth, which is the same width as the hive, but 2½ inches longer. The tin tray is exactly the same length as the hive, and when in use is pushed to the back end of the frame surrounding it, leaving a space of 2½ inches in front for the bees to pass out and in the hive. The other end of the tin tray projects 2½ inches beyond the hive at the back to allow space for filling it. A framework of slats lengthwise of the feeder sits in the tray for the bees to travel over while working in the feeder so that they may not be drowned. The feeder rests squarely on the bottom-board, and the hive covers the feeder except the 2½ inches at the back end, which space is covered by a little board. The bees can not get into the place where the feed is poured in, and the honey (about six quarts) flows evenly under all parts of the hive, where it can be quickly taken up by the bees.

Many fail in their attempt at feeding back for the reason that they do not select the right time of the year. It is best to begin right after the main honey-flow has ceased before the work in the supers is over, and use fresh honey the day it is extracted. At this time the bees naturally go right on as though the flow had not stopped. It is best to give about six quarts of thinned-down honey to each colony every other day. The interval between the feeding allows the bees time to remove the honey, which is first placed directly in the brood-cells, to the supers. No definite rule can be given for thinning down the honey, since the density varies so much. For average honey enough water must be added so that the syrup will be 75 per cent honey and 25 per cent water. Very thick honey needs more water, while thin honey needs less.

It is necessary to have the brood-chamber well occupied by brood, for bees never do well in supers over brood-chambers containing much capped honey. The first requisite, then, is a good queen, which will be able to hold her own against any amount of feeding. The brood-chamber must be contracted, furthermore, so that the queen will be able to keep every comb filled with brood. In this connection the sectional hive is very convenient for the reason that one section may be removed, thus contracting the brood section and still allowing brood in the shallow frames to be under the entire super. It is quite important, however, to have the combs in the brood-chamber as new as possible, for the bees are quite apt to carry up bits of comb to be used in capping cells in the supers, and old dark comb will discolor the super-cappings to quite an extent.

The thinned-down honey should be put into the feeder just before sundown, so that there may be no uproar that may be likely to cause robbing. It is not desirable to have more than two supers of sections on the feeding colonies at a time. As soon as the sections in the super next the brood-chamber are nearly capped, this super should be raised up and the upper one placed under it next to the brood-chamber. Then as soon as the top super is finished and capped solid to the wood, it may be removed and a fresh super placed next the brood-chamber. Of course it is not essential that combs be built out and capped solid to the wood. The combs all capped over, except the cells next to the wood, would grade No. 1.

FEEDING OUTDOORS.—After what we have said elsewhere in this work regarding the danger of exposing sweets in the open air during the robbing season, it may seem the height of folly to recommend what

appears to be the same thing that we have been condemning; but, as we shall show, this outside feeding may be practiced without any attendant bad results that follow from the exposure of sweets under other conditions. It is well known that, when bees are busy in the field in a natural honey flow, hives can be opened without any robbing. Now, then, if we can keep the bees busy by making them go after food, set outdoors, that is of the consistency of raw nectar, we shall accomplish artificially practically the same result.

But as we proceed further the question may be asked, "Why feed outdoors at all if the proper stimulation can be given by placing the food inside the hives that need it, rather than supply all colonies alike, irrespective of whether they need stores or not?"

We may say right here that, under many and most conditions, it is better to feed inside of the hive,* but there are times and circumstances when outdoor feeding will accomplish results that can not be attained in any other way. Let us suppose, for example, that we desire to do some extracting after the main honey flow, when, ordinarily, the bees would be robbing. We will suppose, further, that we have no building properly screened where the work can be done. The good wife objects to our mussing up her kitchen. It is under such conditions that we can remove the desire to rob entirely by creating a light artificial honey flow. Again, we will suppose that we desire to make a general examination of the apiary at a time of the year when bees will rob badly when hives are opened. Or we will suppose again that we are trying to rear queens, and queen-rearing requires the opening of weak nuclei that are particularly vulnerable to robbers. In either case an artificial honey flow will eliminate all danger of robbers, and allow the owner of the bees to go through his hives or nuclei without a robber to interfere.

Or, again, we will suppose the whole apiary needs a little toning up; that there is not time to put feeders on the hives, fill them with syrup, and close the hives up. To feed the whole yard, we will say of 150 colonies, that are on the verge of starvation, will require a day's time. By placing the food outdoors, properly thinned down in two or three large feeders, we can take care of the whole apiary in the space of about ten minutes, or even in five minutes, if all the material is ready at hand. Many a beeman, especially in outyards, is rushed for time. The honey flow will be on in a week or ten days. Help is scarce or high-priced. To feed each individual colony of his outdoors will require much more time than he has at his disposal. But he can practice outdoor feeding by spending just a few minutes at each yard, save quantities of brood, and at the same time can keep every yard booming until food from natural sources is available.

* Feeding outdoors is hard on the field force. It wears them out so that they look like old workers, and soon die.

HOW TO FEED OUTDOORS WITHOUT CAUSING A GENERAL UPROAR OF ROBBERS.

Briefly stated, we give the bees very weak sugar syrup—nine parts of water to one of sugar. This is placed in outdoor feeders capable of holding a gallon or so at a time. Preferably the feeders should be placed about a hundred yards from the apiary. The object of this is to remove any possible excitement that may arise from the immediate vicinity of the hives.

In the way of feeders we prefer those made on the order of the Simplicity trough pattern, described a few pages back. Some 20 or 30 of these feeders placed on scantling properly leveled up will hold a large amount of feed. When these are not to be had, ordinary washtubs or tin pans may be used with suitable wooden floats resting on the top of the syrup to prevent the bees from drowning. In place of wooden floats, corncobs covering the entire surface of the syrup make an excellent substitute. Rather than fill each tub or pan a third or a half full, it is better to have several tubs with the syrup about an inch deep, in order to provide a large amount of surface to the bees to avoid all crowding. One tub with two or three inches of syrup in it will take care of 25 or 30 colonies. We would use about three tubs for 100 colonies. The supply of sugar should be kept close at hand, and, wherever possible, the feeder should be located near a hydrant or pump, or a supply of running water. When first

beginning the feeding, the syrup should be made a little stronger to attract the bees. Then gradually weaken it down to about one to nine. At this strength it does not cause any *furore* in the apiary, and yet it accomplishes the object sought.

Outside feeding does not need to be practiced except at certain hours of the day. When the supply is all gone, the bees will go back to their hives just as they will do in a natural honey flow or when the supply of nectar suddenly gives out, as, for example, after a good downpour of rain. The amount of thin syrup can be so regulated that the supply will be exhausted about the time that the active work in the apiary (we will say of extracting) is finished. Right here, when one is extracting he should feed thinned-down *honey* rather than sugar syrup, and all other times he can use sugar instead.

When outdoor feeding is practiced to prevent starvation the feeding may be continued every day until the natural supply comes in. It will be advisable, perhaps, during the feeding to look over the weaker colonies to see that they are properly evaporating this sweetened water; for it sometimes happens that it will sour in nuclei because there is not force enough to evaporate it.

Right here it may be pertinent to suggest that the excess of water is not all removed while on the hive. If the owner of the bees will place himself in such a position that the outside bees as they rise from the feeder will be between him and the sun, with a background of trees or buildings, he will discover, when they are thirty or forty feet from the ground, from the feeders, that they will discharge what appears to be little sprays of water. Apparently the bees have it in their power to throw off the excess of water from the nectar or syrup while on the wing and before entering the hives. If this is true, it reduces very materially the work of evaporation or ripening of the nectar into an invert sugar known as honey.

Years ago A. I. Root, when he was experimenting with the spider plant, which yields nectar very copiously in the morning—in such quantities, in fact, that it can be seen in large drops—observed that the bees on rising from these flowers, after taking a big drink, would throw out a thin spray of colorless liquid. He set a number of large dinner-plates among and around the spider plants, to catch this spray, and found that it was nothing but water. It contained not the least trace of fecal or saccharine matter. He then concluded (this was away back in the early 70's) that bees have a peculiar power of separating the excess of water from the nectar while on the wing and before arriving at the hive. A number of careful observers have confirmed these early observations since that time, and any one can prove it for himself by feeding outdoors this sweetened water of which we have been speaking.

This brings up a very interesting question. It is a well-known fact that, when bees are fed within the hive, they will immediately rush outdoors if the weather is suitable. It has always been supposed that the sudden supply of food leads them to believe there must be more of it in the fields; but the authors believe that there is a strong probability that this outdoor rush may be due to the fact that the bees, on filling themselves up from the feeder, fly out and discharge some of the excess of water. In opposition to this theory it may be stated that bees fed late in the fall, when it is too cold for them to fly, will store the syrup directly in the combs, without flying out. But late-fed bees are usually given a syrup 2 or 2½ to one—that is, 2½ of sugar to one water. This is practically as thick as ordinary honey. It is possible that, with this thick syrup, it is not necessary for the bees to fly out and discharge the excess of water, for the simple reason that there is no excess.

These are interesting questions which the A B C scholar is asked to help us solve.

FENCE. See Comb Honey.

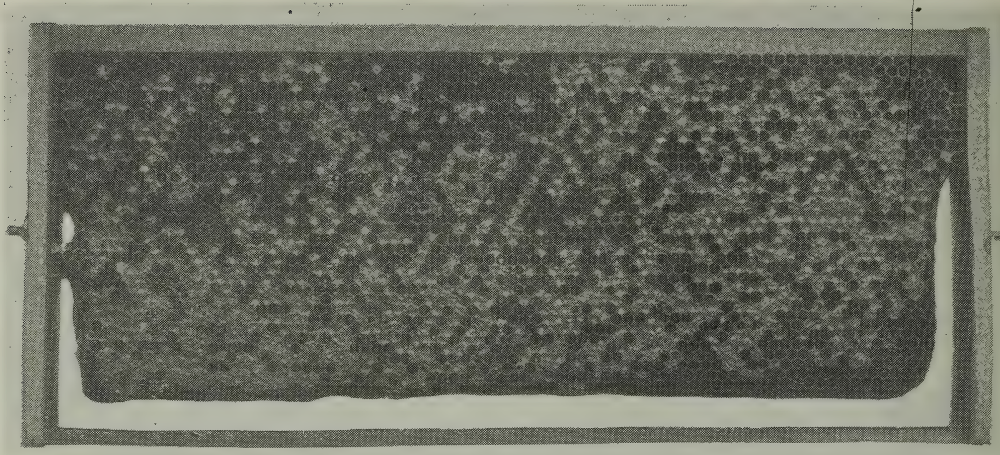
FERTILE WORKERS. See Laying Workers.

FERTILIZATION OF FLOWERS BY BEES. See Fruit-blossoms, also Pollen.

FIREWEED. See Willow-herb.

FIXED FRAMES. See Frames, Self-spacing.

FOUL BROOD.—Under Diseases of Bees we referred to the fact that there are



A comb badly afflicted with foul brood of the ropy or American type.

two classes of the disease—one that affects the mature or adult bees, and one that affects the brood. The former we considered under DISEASES OF BEES, and the latter we will now take up under this head.

Foul brood, technically speaking, refers to two brood diseases—one now known as American, or the old-fashioned diseased brood, caused by *Bacillus larvae,* and one the European, a disease of comparatively recent introduction, caused by *Bacillus pluton.* There is some evidence to show that the European type was present in this country as early as 1890; but it was not until 1899 that the author discovered that there were two distinct types of foul brood. See *Gleanings in Bee Culture,* page 858, for 1899. Shortly after, others, including the foul-brood inspectors of New York (where the European type of foul brood was first discovered), also recognized the difference.

The American form of foul brood, often called the "ropy" type, because the dead matter assumes a gluey, sticky, tenacious character, was well known in Europe, and has been referred to by Dzierzon and other writers. But Mr. Moses Quinby, of St. Johnsville, N. Y., was the first one to recognize it in the United States and prescribe for its cure.

We may say in this connection that the Quinby cure is the basis of the only successful mode of treatment known and recognized to-day, although several have, since Quinby, proclaimed themselves as the original discoverers of it.

Foul brood, either American or European, is the most serious enemy, not even excepting severe winters, with which a beekeeper has to contend. So serious is it that the old-time box-hive beekeepers—the kind who take no bee journal and who read no bee book—are being practically eliminated out of the country. Localities that once had bees on every farm have practically no bees to-day except some in the hands of specialists who keep bees for the bread and butter they can get out of them. There is another class who are still represented, and they are the progressive farmer and the professional man of the towns and cities who are well enough posted to know how to combat foul brood successfully in either one or both of its two forms.

Foul brood, chiefly the American type, has wrought such destruction in this country that the United States census for 1910 shows a large falling-off of bees on the farms. While there has been an increase of beekeepers among the professional class in our cities and towns, there is no denying the fact that the farmer beekeeper has been practically driven out of the business by disease. No more can it be said that "bees work for nothing and board themselves." They might have done so under the old box-hive system, before foul brood had made its fearful inroads, but they can do so no longer. While we can not but deplore the loss of so many farmer beekeepers, yet we rejoice in the fact that the industry of beekeeping is now being

placed on a higher plane—in the hands of the intelligent and the progressive. It goes without saying, that the reader of these lines belongs to this class; and we wish to assure the reader that he need have no real dread of any disease that affects bees if he will follow the plain and simple directions for their treatment that are given in these pages. While, of course, he will and should fear foul brood (not because it can put him out of the business, but because it can annoy him) he should not get the idea that he can not control it, nor that it can prevent him from securing a crop of honey. Foul brood does, however, cause some apprehension in the mind of the queen-breeder and of the man who sells bees; for under our State laws and the United States postal regulations there are severe penalties for shipping diseased bees or infected combs into territory where no disease exists. In this connection it is proper to remark that some thirty-five States and Provinces have stringent foul-brood laws. See LAWS RELATING TO BEES.

But perhaps the most important thing for the reader now to consider is how to know foul brood when it gets a start in the yard. It is comparatively easy to hold the disease in check at its very start, but quite another proposition after it gets a strong foothold. Every beekeeper, therefore, should know the important symptoms of both American and European foul brood. After one actually sees combs affected with either disease, he will have a much better knowledge of them of course; but as that involves considerable danger, especially if the combs are sent by express or mail, the reader will have to depend on photographic representations and a description of the symptoms.

In the first place, we may say that American foul brood had a run in our own home apiary over 25 years ago; and so severe was the attack before we learned how to cure it that we lost over half of our colonies and a honey crop, to say nothing of the ruination of a very profitable trade in bees and queens which had to be summarily discontinued. During the two or three years that we combated the disease we acquired an experience that was valuable—of the kind that Josh Billings told about when he said that "Egsperiense teeches a good skule, but the tuishun kums rather hi," And it was "hi" with us. In addition to this "experience" we have traveled extensively over the United States, visited apiaries where foul brood, both American and European, was present and under treatment. We have seen the two diseases, each in its incipient and advanced stages, and we have seen how they can be successfully combated by the simple methods that are now recommended by our foul-brood inspectors. Besides this, we have had hundreds and hundreds of specimens of affected brood sent from all parts of this country; and at one time our office seemed to be the only place to which samples of brood could be sent for diagnosis. But in later years the United States government, through its Bureau of Entomology, has been making a study of foul brood; and its corps of apicultural experts are now prepared to render assistance in the way of information, so now it is no longer necessary nor advisable to send samples to our office. Indeed, we advise against it, because the Bureau, having trained experts and a bacteriologist, with microscopes and laboratory, are able to make a much more accurate diagnosis of all samples of affected combs or diseased brood sent in.

SYMPTOMS OF AMERICAN OR ROPY FOUL BROOD.

We will first describe American foul brood. As a general thing the beekeeper will not discover it in its incipient stages. He is not expecting it, and, if it comes, does not see it. His first intimation of its presence will be occasional cells of sealed brood showing sunken, greasy cappings with cells with irregular perforations. American foul brood is confined mainly to brood that has died *after* the cells have been sealed; but 25 or 30 per cent of unsealed cells will show dead brood, and the dead larvæ in both sealed and unsealed will vary in color from a yellowish brown to a dark brown, and finally to a brownish black. The larva that has just died holds its shape. As the disease advances it begins to shrink, and the dead matter becomes so rotten and putrid that the skin breaks, and we see on the lower side of the cell a melted-down mass of matter that is very ropy—that is to say, sticky and tenacious. The worst specimens are usually found in the cells that have been sealed, although the melted

broken-down form of larva will be found in some unsealed cells.

In this connection it should be stated that the initial stages of foul brood are usually confined to the sealed cells. After the disease has advanced so that 75 per cent of all the sealed brood in a comb is affected, there will be found quite a sprinkling of stray cells of young larvae that have never been capped over that are dead. But usually the grub will be almost fully grown before it dies in the unsealed cell, tending to show that American foul brood does not usually kill the larva until after it is sealed in the cell, or just before that sealing.

Right here it is pertinent to remark that *European* foul brood is usually confined to the unsealed cells. The dead larva of this disease will have a light-yellow color instead of a brownish-dirty one verging on to very little black. The American may be found at any time of the year when brood-rearing can take place; but the European type usually shows up at its worst early in the season, and before the main honey-flow.

One may find occasional dead brood just before sealing that does not indicate disease of any sort; but the one crucial test that is usually employed to distinguish American foul brood from brood dead from starvation, chilling, or overheating, and brood dead from European foul brood is the roping test. A common wooden toothpick, sometimes a spear of grass or a broken sprig, or even a pin, breaks through the skin of a suspicious larva. If the dead matter appears like spittle or stringy glue at the end of a toothpick, or whatever is used, and strings out from half an inch to two or three inches, one may be almost sure that it is a case of foul brood of the American type—especially if the dead matter strings out two or three inches and finally breaks, the two ends flying back to the points of attachment.

It is very seldom that we find *all* the cells in the comb affected, even in an advanced stage. American foul brood seems to attack a comb in spots. This is due, probably, to the fact that young larvae are fed with a pap or honey containing the germs of the disease. As this affected food is fed by a bee or bees recently in contact with affected material, only the small area so fed is affected. Other small areas are given a food that is not contaminated; and all such brood matures and is healthy, and is as perfect as any normal brood. As a rule, in the worst-affected cases half of the brood will hatch out perfectly healthy and normal bees, so that foul brood, either American or European in its very worst stages, does not necessarily kill a very large part of the brood; but, of course, if the colony containing it is neglected, every cell in the comb will ultimately become diseased. We will refer to this again under the head of "Treatment of American Foul Brood."

The name (foul brood) would indicate that it is foul-smelling. In a very advanced stage one can detect a strong odor like that from an old-fashioned glue-pot while the glue is hot. The odor is not necessarily foul nor nauseating; but there is a stage (and that is when almost every cell is affected) when the odor is distinctly foul—so much so that one feels he can not continue to smell it without its turning his stomach. After one has once had a whiff of genuine foul brood he can very often detect the odor by placing his nose at the entrance of the hive. The author has frequently located colonies having the disease by simply getting down on his hands and knees and placing his nose close to the entrance and taking a number of deep inhalations through the nostrils. In fact, we would advocate going through an apiary where we suppose the disease to exist, especially if robbers are present, and locating the colonies having foul brood by the peculiar odor that may be detected at their entrances. And right here it should be stated that often this odor can not be detected at the entrance, especially if it is a mild case. All colonies where the odor is found, however, should be marked; and then toward night, or under a robber cage, as described under ROBBING (which see), one can then examine the combs carefully one by one to determine whether there are any cells, sealed or unsealed, containing dead ropy matter. As soon as a single cell has been discovered, that hive should be *immediately closed and held for treatment.* It is of the utmost importance that *not a single robber should be allowed to get into an infected hive or a taste of honey containing disease germs.* While foul brood

is often spread by a general exchange of combs during extracting or for equalizing the strength of the colonies, nine times out of ten disease is spread from hive to hive and from one apiary to another through robbing. Foul brood, we will say, starts in a few box hives on a farm. The colonies become weakened during the summer because disease does not destroy them immediately. In their weakened condition they die during winter, and the following spring bees in the neighborhood rob out these dead colonies, thus carrying the infection to their hives. No wonder that the farmer beekeeper is being eliminated.

But to return to the odor at the entrance. We remember that on one particular occasion we located a colony having foul brood by an occasional whiff we could catch at the entrance; but it was nearly a week after that when we found one cell containing ropy dead matter. Apparently the colony had nearly cured itself. But there still remained a characteristic odor which could not be eliminated. Our experience showed that a colony which cures itself does not stay cured. The stock may be vigorous enough to keep the disease down; but an occasional cell will manifest itself for the ensuing ten or twelve years—and in the mean time be a constant source of infection to all the rest of the apiary. There would be some colonies that would not be able to resist, hence the danger.

As we shall show presently, a vigorous stock will often, when the right conditions are provided, cure *European* foul brood without the destruction of combs or a change in the hive. But do not confuse European and American foul brood on this point.

Sometimes one can detect a glue-pot odor at the entrance of one of the hives. He will be horror-stricken, as sure as fate, and say that he has run across the unmistakable smell, and that the disease is surely present in his apiary. This fear will be dissipated if he understands that the same foul-brood smell, or at least one very much like it, may have come from a lot of putrid dead bees after a severe winter. These dead bees may be in the hive or at the entrance. Again, overheated brood or chilled brood, if neglected until it fairly rots, will give off a similar odor. The reader will understand, therefore, that the odor test is by no means final; but it is very suggestive, provided no dead bees are found, and providing that one knows that the brood of the hive from which the odor emanates has not been chilled nor overheated. But we have heard beekeepers say that they do not regard the odor from foul brood as foul as the authorities have stated. That is true. A good deal will depend on the kind of nose one has. An odor that is sickening to one is not necessarily so to another.

Pictorial representations help considerably to give one a good idea of the appearance of combs affected with American foul brood, especially the shape of the peculiar ragged perforations through the cappings. And, besides, a foul-brood comb has an appearance which, when once seen, is always recognized thereafter.

TO DISTINGUISH FOUL BROOD.

The smaller half-tone shows a comb, almost every cell of which is affected. When a colony has one such frame as this, the disease has progressed to such a stage that the probabilities are that other colonies in the same locality are affected, especially those having entrances pointing in the same direction or similarly located. And right here the beekeeper should be warned that colonies next to the one badly affected are very apt to show this fell disease. This is explained on the ground that young bees and even the adult ones become more or less confused at their entrances, and so get into the wrong hive. As they do not show any of the manifestations of ordinary robbers, they are admitted. If they carry honey from an infected colony, as many of them do, they will transmit the disease as soon as they give pap made out of such honey to young brood; and that explains why there will be only a single cell or a group of cells perhaps, or one square inch that will have foul brood, while all the rest of the brood in the hive is perfectly normal. We generally expect to find in one or more neighboring hives with entrances facing in the same direction a cell or two of foul brood. If one can be sure that the comb containing the diseased cell or cells is the only one affected, the removal of that comb may effect a permanent cure. But how are we to know? As we shall presently state, all such colonies should receive a thorough treatment.

There is a kind of pinhole perforation that does not signify anything wrong—indeed, quite the contrary. As bees seal up their brood, there is a stage when there will be a small round hole in the center of the cap. Sometimes these holes are not closed up, and then we have what is called bareheaded brood. See BEES; also DEVELOPMENT OF BEES. But the perforations in bareheaded brood are very different from the perforations in cells containing foul brood, either American or European. The bad cells should have sunken cappings. The perforations are ragged, triangular, and the edges appear to be somewhat greasy, while in the perforations in bareheaded brood the cappings are slightly convex, and the hole is circular.

We have said that a ropy condition of the dead matter is an important symptom of American foul brood. Perhaps we ought to say that it is the most important, because it is the one test by which we distinguish American foul brood from all other brood diseases, particularly the European type. While the dead matter of the European disease will rope slightly—perhaps from an eighth to a quarter of an inch or so—the dead matter of the American disease will draw out like spittle, anywhere from half an inch to two or three inches, as already explained. A ropy condition of the dead matter, with ragged and sunken perforations, and the glue-pot odor, make up a combination which, if all are present, makes identification certain. But we advise any one who has any dead brood of any sort to send a specimen of it in a stout wooden or tin box to the Bureau of Entomology, addressed to the Apicultural Expert. The brood should first be wrapped in porous paper to absorb drip, and, so far as possible, all the dripping honey should be cut away to avoid soiling the mail-bags, and, what is of more importance, to prevent the spread of the disease wherever the dripping package may be temporarily exposed where bees may be present. It is particularly important to send specimens of brood to the Government when the brood does *not* rope—when the dead matter takes on a bright yellow rather than a dark brown, and when, too, it is confined to the unsealed cells. This would indicate European foul brood.

THE TREATMENT AND CURE OF AMERICAN FOUL BROOD.

At the outset we spoke of the Quinby method as being the basis of the most successful treatment for American foul brood. This plan involved the melting-up of the old combs (shaking bees into clean hives) and compelling the bees to start anew. As this treatment was described before foundation was known, of course no mention of it was made. Practically the only improvement over the Quinby treatment is giving the bee starters or full sheets of foundation instead of empty frames with mere wooden guides. In more recent times the late D. A. Jones, of Beeton, Ont., gave out what he called the "starvation" plan. It involved the same principle as the Quinby treatment, with this difference, that he shut the combless bees after shaking, in a large wire-cloth box, or a box with wire-cloth cover, and set it in a cool place until the bees had consumed all the honey in their honey-sacs. This idea was to eliminate all possible sources of infection before the bees were put on frames of foundation and fed. The treatment worked admirably; but it was found in later years that it was not necessary to starve the bees—that they would use up any infected honey that they might have in their sacs in drawing out foundation, providing the hive has no combs. About this time, Mr. Wm. McEvoy, of Canada, who had then recently been appointed foul-brood inspector for Ontario, had been very successful in shaking the bees into their own hive, and giving them frames of foundation starters. They were allowed to build combs on these for four days. His idea seemed to be to let the bees use up the infected honey in building the combs and storing it in the built comb. These combs supposed to contain infection were then removed, when they were given full sheets of foundation. But experience has shown in thousands of cases that it is not necessary to remove the first set of combs built on foundation starters, and that such removing involves a large amount of waste; and that, when the second set of foundation is given, the bees are in a demoralized condition, and quite inclined to swarm out.

Years ago, when we had foul brood, we shook 80 colonies and gave them only one set of frames with full sheets of foundation

in clean hives. The treatment was a success in every case. Although we have prescribed this same treatment in hundreds if not thousands of cases, we have never yet had one report saying that the disease had returned. We believe that the bees, as a matter of fact, will either consume or use up all the infected honey in drawing out the first set of foundation; and we also believe that it is very important to give the bees either a clean hive or disinfect the old one. When we shook into the old hives the disease came back in some cases. This disinfecting may be best accomplished by burning it out with an ordinary blow torch, such as is used by telephone men and painters to remove paint from a house; or it may be accomplished by smearing the inside of the hive with kerosene, touching a lighted match to it, and letting it burn until the inside of the hive is charred to a brown or black. The fire may be easily arrested by using a little water and clamping on the cover immediately. The steam, generated when the cover is clapped down, immediately puts out the fire. But there may be an objection to kerosene leaving an offensive odor in the hive. Another plan is to use a handful of common dry straw, setting it on fire, and then with a stick poke the burning straw around the hive so that every portion of it will be slightly scorched. The straw should be dumped out, and a little water dashed in the hive. But the shaking treatment, to be carried out as it should be, requires some precaution to prevent absconding. The Bureau of Entomology has recommended a mode of procedure which we most thoroughly indorse, and we are glad to recommend it. As our government experts have made foul brood a more careful study than any other set of men in the United States, we can not do any better than to advise our readers to follow faithfully the treatment recommended in Farmers' Bulletin 442, entitled "The Treatment of Bee Diseases," by Dr. E. F. Phillips, in Charge of Apiculture, Bureau of Entomology. For convenience of the reader we give it here.

SHAKING TREATMENT.

The shaking treatment consists essentially in the removal of all infected material from the colony, and in compelling the colony to take a fresh start by building new combs and gathering fresh stores. This is done by shaking the bees from the old combs into a clean hive on clean frames.

TIME OF TREATMENT.—The shaking treatment should be given during a flow of honey, so that other bees in the apiary will not be inclined to rob. If this is not possible the operation may be performed under a tent made of mosquito netting. The best time is during the middle of a clear day when a large number of bees are in the field. It is sometimes recommended that shaking be done in the evening, but this is impossible if many colonies are to be treated. The colony can be handled more quickly when the field force is out of the hive.

PREPARATION.—All implements that will be needed, such as queen and drone trap, hive tool, and lighted smoker, should be in readiness before the operation is begun. A complete clean hive with frames is provided, as well as a tightly closed hive body in which to put the contaminated combs after shaking. An extra hive cover or some similar apparatus should be provided to serve as a runway for the bees as they enter the new hive. The new frames should contain strips of comb foundation from one-fourth to 1 inch wide. Full sheets are not desirable, and if combs built on full sheets of foundation are desired they may be built later.

OPERATION.—The old hive containing the diseased colony (fig. 6, *A*) is now lifted to one side out of the flight of returning field bees and the clean hive (*B*) set exactly in its place. The cover (*G*) is now taken off and a few frames (*E*) removed from the center of the hive. If unspaced frames are used, those remaining in the hive should be pushed tightly to either side of the hive, thus making a barrier beyond which the bees can not crawl as they move to the top of the hive after shaking. This largely prevents them from getting on the outside of the hive. If self-spacing frames are used, a couple of thin boards laid on the top bars on either side will accomplish the same result. The runway (*D*) is put in place in front of the entrance. The old hive is now opened for the first time. The frames are removed one at a time, lowered part way into the new hive, and with a quick downward shake the bees are dislodged. The frames are then put into the extra hive body (*C*) and immediately covered to prevent robbing. After all the frames are shaken the bees remaining on the sides of the old hive (*A*) are shaken out.

If honey is coming in freely, so that thin honey is shaken out of the combs, cover the runway (*D*) with newspapers and shake the bees in front of the new hive (*B*), leaving all frames in place and the cover on. After the operation the soiled newspapers should be destroyed. In shaking in front of the entrance the first one or two frames should be so shaken that the bees are thrown against the entrance, where they can locate the hive quickly. They then fan their wings and the others follow them into the hive. If this is not done the bees may wander about and get under the hive or in some other undesirable place.

After the bees are mostly in the new hive a queen and drone trap (*F*) or a strip of perforated zinc is placed over the entrance to prevent the colony from deserting the hive. The queen can not pass through the openings in the perforated zinc and the workers will not leave without her. By the time that new combs are built and new brood is ready to be fed, any contaminated honey carried by the bees into their new hive will have been consumed and the disease will rarely reappear. If it should, a repetition of the treatment will be necessary.

SAVING THE HEALTHY BROOD.—The old combs are now quickly removed. If several colonies are being treated at one time it may pay to stack several hive bodies containing contaminated combs over a weak diseased colony to allow most of the healthy brood to emerge, thereby strengthening the weak colony. After 10 or 12 days this colony is

treated in turn and all the combs rendered into wax. If only one or two colonies in a large apiary are being treated it will not pay to do this.

Saving the Wax.—Any but a very small apiary should have included in its equipment a wax press for removing wax from old combs. After the contaminated frames are taken to the honey house the combs should be kept carefully covered, so that no bees can reach them until the wax can be rendered. This should not be delayed very long or the combs may be ruined by wax-moths. The slumgum or refuse remaining after the wax is removed should be burned. Contaminated combs should not be put into a solar wax-extractor for fear of spreading the disease. The wax from contaminated combs may safely be used for the manufacture of comb foundation.

Cleaning the Hive.—The hive which has contained the diseased colony should be thoroughly cleaned of all wax and honey, and it is desirable that it be carefully disinfected by burning out the inside with a common gasoline blue-flame torch. If this piece of apparatus is not available several hive bodies may be piled together on a hive bottom and some gasoline or kerosene poured on the sides and on some straw or excelsior at the bottom. This is then ignited and after burning for a few seconds a close-fitting hive cover is placed on top of the pile to extinguish the flames. The inside of the hive bodies should be charred to a light brown. The careful cleaning and disinfection of frames always costs considerably more in labor than new frames would cost, but these also may be carefully cleaned and used again. Frames may be cleaned by boiling in water for about half an hour, but this frequently causes them to warp badly. The disinfection of hives and frames with chemicals is not recommended, as the ordinary strengths used are valueless for the purpose.

Disposal of the Honey.—If there is a considerable quantity of honey in the contaminated combs it may be extracted. This honey is not safe to feed to bees without boiling, but it is absolutely safe for human consumption. If there is a comparatively small quantity it may be consumed in the beekeeper's family, care being taken that none of it is placed so that the bees can ever get it.

To place such honey on the market is contrary to law in some States. There is always danger that an emptied receptacle will be thrown out where bees can have access to it, thus causing a new outbreak of disease. It can be safely used for feeding to bees provided it is diluted with at least an equal volume of water to prevent burning, and boiled in a closed vessel for not less than one-half hour, counting from the time that the diluted honey first boils vigorously. The honey will not be sterilized if it is heated in a vessel set inside of another containing boiling water. Boiled honey can not be sold as honey. It is good only as a food for bees, and even then should never be used for winter stores, as it will probably cause dysentery.

The Second Shake.—Some beekeepers prefer to shake the bees first on to frames containing strips of foundation as above described, and in four days to shake the colony a second time on to full sheets of foundation, destroying all comb built after the first treatment. This insures better combs than the use of strips of foundation, but is a severe drain on the strength of the colony. Since it is desirable to have combs built on full sheets, the best policy is to replace any irregular combs with full sheets of foundation or good combs later in the season.

The Cost of Shaking.—If the treatment just described is given at the beginning of a good honey flow, it is practically equivalent to artificial swarming and results in an actual increase in the surplus honey, especially in the case of comb-honey production. The wax rendered from the combs will sell for enough to pay for the foundation used if full sheets of foundation are employed. Since a colony so treated actually appears to work with greater vigor than a colony not so manipulated, the cost of treatment is small. If treatment must be given at some other time, so that the colony must be fed, the cost is materially increased. In feeding, it is best to use sugar syrup, or honey that is known to have come from healthy colonies.

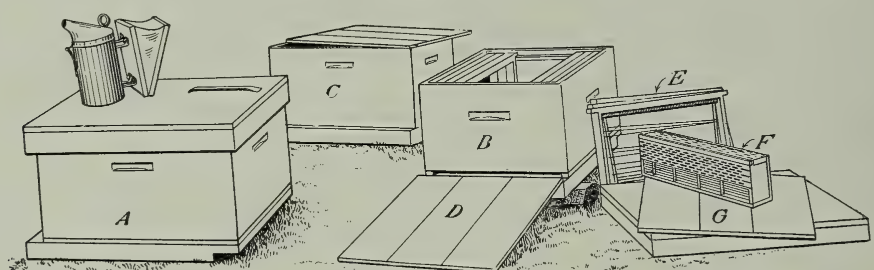


Fig. 6.—Apparatus for the shaking treatment: *A*, Hive containing diseased colony (formerly in position of *B*); *B*, clean hive; *C*, empty hive to receive combs after shaking; *D*, hive cover used as runway; *E*, frames removed from *B* to give room for shaking; *F*, queen and drone trap; *G*, cover for clean hive, *B*. (Original.)

TREATMENT WITH BEE ESCAPE.

As a substitute for the shaking treatment just described, the bees may be removed from their old combs by means of a bee escape. The old hive is moved to one side and in its place is set a clean hive with clean frames and foundation. The queen is at once transferred to the new hive and the field bees fly there on their return from the field. The infected hive is now placed on top of or close beside the clean hive and a bee escape placed over the entrance, so that the younger bees and those which later emerge from the cells may leave the contaminated hive but can not return. They therefore join the colony in the new hive. If desired, the infected hive may be placed above the clean hive and a tin tube about 1 inch in diameter placed from the old entrance so that the lower end is just above the open entrance of the new hive. The bees follow down this tube and on their return enter the new hive. When all of the healthy brood has emerged from the infected combs the old hive is removed. This treatment induces less excitement in the apiary and is preferred by many experienced beekeepers. Care should be taken that the old hive is absolutely tight to prevent robbing. The old hive and its contents of honey and wax are treated as indicated under the shaking treatment.

FALL TREATMENT.

If it is necessary to treat a colony so late in the fall that it would be impossible for the bees to prepare for winter, the treatment may be modified by shaking the bees on to combs entirely full of honey so that there is no place for any brood to be reared. This will usually be satisfactory only after brood rearing has entirely ceased. Unless a colony is quite strong it does not pay to treat in the fall, but it should be destroyed or united to another colony. In case a diseased colony dies outdoors in the winter there is danger that other bees may have opportunity to rob the hive before the beekeepers can close the entrance. In case bees are wintered in the cellar it is more advisable to risk wintering before treatment, for if the colony does die the hive will not be robbed.

DRUGS.

Many European writers have in the past advocated the use of various drugs for feeding, in sugar syrup, to diseased colonies, or the fumigation of contaminated combs. In the case of American foul brood, of which the cause is known, it has been found that, the drugs recommended are not of the slightest value, and no time should be wasted in their use.

EUROPEAN FOUL BROOD.

As we have already explained, this is a disease that has some symptoms that are the same as those of American foul brood; but it has other symptoms that are quite different. In its general appearance, especially in its advanced stages, a comb affected will look somewhat like those of American foul brood; but a more detailed examination will show a decided difference.

1. The European disease is seldom if ever ropy. The dead matter has more of a jellylike consistency; and if it clings to a toothpick, the roping will not extend more than a half-inch at most.

2. The disease comes on mainly in the early part of the season, and it is confined largely to the unsealed brood. The dead grubs do not finally assume a shapeless melted-down mass as we find it in the American type of the disease. Indeed, they retain their shape without a break in the skin, finally shriveling up into dry scales which the bees easily remove. The dried scales on American foul brood, on the contrary, stick to the side of the cell like so much glue; and it is very easy to detect combs previously affected with this disease, although it may be a year or so afterward, because the lower sides of the cells look as though they had been daubed over with some sort of gluey substance with a remnant of larval skin.

3. The ordinary glue-pot or foul-brood odor is almost entirely lacking in combs affected with European foul brood. There is, in place of it, a sour, musty, or rotten-egg smell that is not easily recognized as the odor of the other brood disease. In the later stages it takes on a foul odor something like that of the American disease, in which stage the sour smell seems to be lost or obscured by the more pronounced odor of decay. The color of European foul brood in its earlier stages is a bright yellow. Indeed, the yellow color may be taken as its chief characteristic.

4. European foul brood seems to spread much more rapidly than American. If an apiary is affected at all, more colonies will be involved; but in the American type of the disease, honey seems to be the main source of infection. In the European type, honey may be the source, but certainly it does not seem to be the only means for its transmission.

5. Black and hybrid bees are much more subject to the ravages of European foul brood. Indeed, in a few cases the mere introduction of a vigorous strain of young Italian queens seems to cure the whole apiary. There are some localities in New York where Italian apiaries are surrounded by apiaries of black and hybrid bees; and yet the remarkable fact is that these Italian yards are free from disease while the yards of common bees around them are affected with it in spite of treatment by shaking. In other localities, especially those where there is no fall flow, a vigorous Italian stock may or may not be able to throw it off. In this connection it is proper to state that there are some strains of vigorous hybrids, hustlers for honey, that seem able to hold European foul brood in check; but the testimony of inspectors, as well as of beekeepers all over the country, seems to unite in the general statement that a vigorous strain of Italians, hustlers for honey, will do much to eliminate the disease, and eliminate it entirely, providing other curative measures are applied.

6. There also seems to be a general agreement among authorities who have studied European foul brood, that weak colonies are the ones that are first attacked. It is, therefore, very important, where this disease gets into a yard, that all the weak ones be doubled up; for it is *only the strong and extra strong that will be able to combat it,* even when they are given

every assistance possible on the part of the owner.

7. Again, it has been noticed that, as soon as a good honey-flow is on, European foul brood begins to disappear; and sometimes as soon as there is a dearth of honey it shows a tendency to break out again, particularly when brood-rearing is well under way in the spring, for that is the time of year when it usually makes itself manifest.

TREATMENT AND CURE OF EUROPEAN FOUL BROOD.

Having suggested some of the salient characteristics of the European disease, we are now ready to discuss methods of cure. The State inspectors of New York have been recommending the shaking plan, or the same treatment that works so successfully with American foul brood; but, unfortunately, experience shows that the disease will reappear in the shaken colony in many cases, while in others a complete cure seems to be effected. If the shaking plan is faithfully applied to a colony having American foul brood, a complete cure is assured. The fact that the European disease may come back again, even after shaking has been applied, is somewhat discouraging; but in many localities it seems to be the only method that can be recommended when we take in connection with it the making of extra-strong colonies, and supplying vigorous young Italian queens when the honey-flow is on; for it is always desirable to apply treatment at such time. The shaking plan for European foul brood that we recommend is the one advocated by the Bureau of Entomology, already given for the treatment of American foul brood.

But why does the shaking plan fail?* Primarily because it weakens the colony, puts it into a discouraged condition, gives it a general setback, and while in this condition it is an easy subject for a second attack. It is, therefore, strongly urged that, *before* shaking, the colonies be made strong by giving healthy hatching brood; and it is sometimes advisable to give such brood after shaking.

In this connection we might state that there is a great difference in Italians. Some are much more immune to the disease than others; and if one breeder can not supply the right stock, another should be tried.

So many have been the failures by the shaking plan that another treatment has been recommended, known as the Alexander plan. In this connection it is but fair to state that, while this treatment has given excellent results in the hands of a number of beekeepers, in many localities it has been only partially successful. Indeed, a few have become disgusted with it, and gone back to the shaken plan. Here is the treatment as given by Mr. Alexander in 1905, in *Gleanings in Bee Culture.*

This cure is on the line of introducing new blood into the apiary, which will necessitate getting a choice Italian breeding-queen, one of the best honey-gathering strains that can be procured. For this special purpose I prefer quite yellow Italians. Now for the cure.

Go to every diseased colony you have, and build it up either by giving frames of maturing brood or uniting two or more until you have them fairly strong. After this, go over every one and remove the queen; then in nine days go over them again, and be sure to destroy every maturing queen-cell, or virgin if any have hatched. Then go to your breeding-queen and take enough of her newly hatched larvae to rear enough queen-cells from which to supply each one of your diseased queenless colonies with a ripe queen-cell or virgin just hatched. These are to be introduced to your diseased colonies on the twentieth day after you have removed their old queen, *and not one hour sooner,* for upon this very point your whole success depends; for your young queen must not commence to lay until three or four days after the last of the old brood is hatched, or 27 days from the time you remove the old queen. If you are very careful about this matter of time between the last of the old brood hatching and the young queen commencing to lay, you will find the bees will clean out their breeding-combs for this young queen, so that she will fill them with as fine healthy brood as a hive ever contained. This I have seen in several hundred hives, and have never seen a cell of the disease in a hive after being treated as above described.

It is not necessary to remove any of the combs or honey from the diseased colony; neither is it necessary to disinfect any thing about the hive. Simply remove the old queen, and be sure the young queen does not commence to lay until three or four days after the old brood is all hatched. This treatment with young Italian queens is a perfect cure for black brood.

In regard to those old queens that were formerly in your old hives, I think it best to kill them when you first take them from their colonies—not that the queen is responsible for the disease, for I am sure she is not; but a young Italian queen that has been reared from a choice honey-gathering strain is worth so much more to you that I can not advise saving these old queens.

* Shaking just at the beginning of a good flow does not weaken a colony but actually increases the crop as it is "shook swarming." The condition of the colony after shaking depends on the way it is done. Some beekeepers completely disorganize a colony while others manipulate so as to get the opposite effect. Rapidity is a vital part of shaking. When you count the crop results shaking is not more expensive than the other methods—always provided the beekeeper manipulates wisely.—*E. F. Phillips, expert in charge of Apiculture, Bureau of Entomology, Washington, D. C.*

I have experimented along this line considerably, and found, after the colony has been without a queen 27 days, as above directed, it will usually be safe to give them one of these old queens, and the cure will be the same. Still, there have been exceptions, so I advise killing them at once.

Now a few words about your breeding-queen. Buy one of the very best you can for this purpose; for upon her real merits rests the true value of your apiary hereafter. I would buy a three-comb nucleus with this valuable queen, so as to run no risk in introducing her to a full colony.

It should be noted that Mr. Alexander lays strong emphasis on the importance of having colonies made *extra strong*, of *pure Italian* stock, and a *queenless condition for* 21 *days*, when a cell or a virgin is given. These important requisites in applying this treatment must not be overlooked.

Now, then, why does the Alexander plan fail with some, and work successfully with others? In a few cases it is evident that his instructions have not been carefully followed. In other cases it is very apparent that the right strain of Italians has not been secured; in still others that the locality is not adapted to that kind of treatment. In order to make it work, there should be a good fall flow of honey. When the treatment is applied just before this fall flow, and vigorous Italian stock used, a complete cure is usually the result. But many do not have this fall flow. Some are unable to secure a vigorous strain of Italians. In such cases the shaking treatment should be applied. Indeed, a combination of the two treatments may be used to advantage. Mr. F. B. Cavanagh, of Hebron, Ind., who has had much experience with both the Alexander and the shaking plan, recommends a combination of the two plans as giving excellent results. We give it here.

Assuming that you are a wide-awake beekeeper, which means that you have discovered the disease within a few weeks of its development, it is improbable that more than one-third to one-half of the colonies in the yard are affected. Such being the case, the following I believe to be the most economical and safest treatment.

Inspect the entire yard at the first sign of the honey-flow, being careful, of course, not to excite robbing, and mark all the hives with indelible crayon, indicating the mild cases by one cross, the bad cases by two, and the healthy colonies, O. K. Double or treble up all badly diseased or weak hives at the time of inspection, as we want them strong to begin with, so that they can spare their brood without bad effects. Also remove these queens as soon as possible, for they are worthless and a detriment to the cleaning-up process.

As soon as the honey-flow is sufficiently good, start enough queen-cells from the best yellow three-banded stock that you can get, to requeen the entire yard. When the cells are ready to introduce, make up enough strong nuclei to supply the healthy colonies with queens, and isolate them from the rest of the apiary (for they are more easily infected than strong colonies), or mate your queens in the full colonies if you prefer.

The honey-flow now being in full blast, the one "bad cases" very strong, and having been queenless at least nine days, brush each of these colonies on to full sheets of foundation and one comb containing some healthy unsealed brood and honey, and a protected queen-cell. The full sheets prevent drone comb, and there is no danger now of developing any disease in the single comb left, every available cell of which will be filled with honey or polished up for the new queen.

Place the brood-nests over strong healthy colonies having their queen confined below. It matters not how many partly filled supers of honey we have between the regular brood-nest and the annexed brood-nest, which now becomes an extracting-super.

The brood-nests which become extracting-supers should never be extracted until all brood is hatched and the cells filled with honey. The pollen will be used up by this time in most cases, and the combs, when dry, will be perfectly safe to use under any circumstances. You will understand that we have nothing in particular to fear from infected honey at this season, when *immunity is established* by the heavy honey-flow; hence the uselessness of twice shaking. Our aim is, in removing the honey, to fortify against reinfection from this source when the season arrives for susceptibility.

Next requeen the slightly infected cases in which the disease has probably by this time disappeared by giving protected cells in place of the queens. At the next extracting, when it is time for the young queens to be laying, put the extracting-supers below the brood-nest, throwing plenty of grass on the entrance to prevent robbing until the bees discover the new order of things. A day or two later, brush these colonies down, placing an excluder to confine the queen in the lower story. If the colonies are strong and the honey-flow good, the bees will be crowded below with the young queen, which will gladly accept the situation. Use the exchanged brood-nest as the future extracting-super, which will soon be filled with honey.

The healthy colonies will now have to be requeened; and, disagreeable as I know it to be, it is necessary to lift off those three or four supers and hunt up the old queen. The nuclei containing young laying queens may be united with the healthy colonies after two days' queenlessness by placing the combs, with bees thereon, in the full hive.

You have, no doubt, been wondering why I advocate brushing instead of shaking. Well, for one thing it is less cruel. The treatment, given as it is, early in the honey-flow, when the nectar is thin and easily shaken out, fills the breathing orifices of the bees, no doubt causing them useless suffering if no other bad effects.

Brush the bees down out of the supers or bodies, as described in the *Bee-keepers' Review* in 1909. Placing the brood-nest to be cleared of bees above the prepared empty hive, remove a comb from the side nearest you; brush the bees in front of the alighting-board, and cover the comb securely. With a Coggshall bee-brush in the right hand, and the smoker held suspended between your body and the hive, the left hand is now free to space the combs toward the operator. First, smoke the bees down while breaking the frames loose; next, pocket the hive-tool and in turn brush the inside of the hive nearest you, and each alternate space between combs, twisting the brush enough to reach both sides of the combs adjacent at once. In our apiaries we work rapidly, using a series of gentle vibra-

tions of the brush, which fans and distributes the small amount of smoke used just where we want it, instant with dislodging and frightening the bees down. There is no time for them to crawl back to the cleaned surface of the comb before it is slipped over, always toward us, and the other side brushed. At the last comb the brushing will include the furthest side of the hive with the outside of the last comb, when the body or super must be quickly removed. For two years both my assistants and I have used this system entirely when extracting or clearing brood-nests. It is quick and positive in results, a complete "Waterloo" to robbers, easy on the operator, arouses practically no cross bees, and loses fewer queens, we find, than shaking. Like other systems, little acquired knacks soon become fixed habits. The operator learns to puff the smoke behind the end-bars pretty well at the beginning of the operation, which gets the bees well toward the center of the combs and in reach of the brush. Also the smoker bellows, while suspended against the hive, is worked by pressure of the body, which exercise we believe to be healthful, as we always have large appetites when extracting honey.

The reader will doubtless come to the conclusion that European foul brood is difficult to handle. As a matter of fact, in many localities it costs less to cure it than the American, especially if the introduction into the yard of a vigorous strain of Italians is sufficient. Indeed, we may say that some queen-breeders in this country are getting orders for queens in hundred lots for the simple purpose of Italianizing an apiary infected with European foul brood. When the Alexander treatment has been applied in late summer, with a fall flow of honey in sight, the cost of curing the disease does not much exceed the cost of the queens. Not a few reports have been received showing that the Alexander treatment has completely cured an apiary, and in other cases so far effected a cure that but little trouble has since been experienced in holding the disease in check. The value of the Alexander treatment lies in the fact that all combs and brood may be saved; and that is of no small consequence in an extracting-yard where what is known as a "drawn comb" is worth two frames containing full sheets of foundation.

When practicing the shaking plan, the brood can be saved after shaking by placing it over weak colonies having the disease, with a queen-excluder between the brood-nest proper and the combs above. In some cases these combs can be saved, but more often they should be melted up after the brood hatches out. The hatched brood will make the original weak colony very strong, and it will then be in prime condition for shaking, when the cure will be complete nine times out of ten.

DEAD LAYING-WORKER BROOD.

In colonies where laying workers get started we are quite apt to find brood in some stages dead. This is doubtless due to the fact that bees know something is wrong, and they do not take pains to take care of it as they should. At all events, it appears to be neglected, and some of it is either chilled or starved. The reader, therefore, must not become alarmed if he finds dead brood in hives containing laying workers.

PICKLED BROOD AND ITS CAUSE.

The name pickled brood has been applied to almost any form of dead brood that was not foul brood. In a rather general way, it seems to cover, then, any form of brood that is dead from some natural causes not related to disease of any sort. Pickled brood looks very much like European or black brood. The larva dies, lying on its side in the bottom of the cell, both ends of which begin to turn a little yellow, brown, and then black. The discoloration seems to creep along until the whole body is involved. About this time the larva begins to shrivel and finally dries up. The real pickled brood is probably nothing more nor less than starved brood. If there is a lack of stores the bees will neglect the brood, when it will die, as before described. But there may be a great abundance of honey or syrup in the hives, and still the larvæ will die. Some springs and early summers there is a lack of pollen. In order that brood-rearing may be carried on in the hive there must be nitrogenous food of some sort, either of natural pollen or of bean or rye meal which the beekeeper may set out. Sometimes malted milk powder is strewn over the combs; but as this is rather expensive, we would advise giving the bees bean or rye meal, or any meal that is obtainable from some grain. This should be put on boards in a sunny protected place outdoors. See Pollen, subhead "Artificial Substitutes for Pollen."

During the early spring of 1909 considerable pickled or dead brood was reported from various sections of the country. Investigation revealed the fact that this was nothing more nor less than *starved* brood; starved, not because of a lack of honey or

syrup, but because of the entire absence of pollen in the combs. A good deal of brood-rearing had started from pollen that was left over from the season before; but when this was exhausted, the poor bees, not being able to get any thing from natural sources, simply had to let the brood die. It is important, therefore, to see that all hives during the previous fall are supplied with pollen in one or two combs, for there can be no brood-rearing without pollen.

CHILLED, OVERHEATED, OR POISONED BROOD.

If the grubs all seem to have died about the same date, one may conclude some external change, probably a chilling atmosphere, or an exposure of the combs to a sudden change in the weather was the cause —particularly so if he discovers no odor of sourness or foulness. If the brood that comes on subsequently seems to be healthy, and continues to be so, then he may be sure he has no infectious disease. He may then conclude that his brood is probably chilled and possibly poisoned, as a large amount of brood dies every fruit-bloom season, as the result of poison sprayed on the trees by the orchardist. If he finds any such dead brood in his hives at that season he may conclude it died as the result of poison. See FRUIT BLOSSOMS, subhead "Spraying during Bloom Destructive to Bees."

Overheated brood does not often occur except in the hottest weather, when the combs have been exposed to a hot sun without any bees over it, or when the same has been confined with a powerful colony with a closed entrance. When moving bees, and insufficient ventilation is given, many of the bees often die of overheating. In all cases of this kind much of the brood will be found dead. One will very often find that some of the brood looks suspicious from a shipment of bees just received by express. Occasionally we have had reports from our customers of how they had received foul brood through a shipment of bees, not knowing that the nucleus or the hive of bees is often exposed by the expressman. during shipment, to a hot sun or in a room with no air circulating.

FORMALIN, OR FORMALDEHYDE, FOR CURING FOUL BROOD.

In 1903 and '4 discussion arose in *Gleanings in Bee Culture* as to the possible value of formaldehyde (or formalin) for curing foul brood. Some of the experimenters who had subjected several combs of honey and brood from infected colonies to the fumes of the gas in a tight box reported it a success. Others tried the same thing only to find that such combs would transmit the disease the same as before. Experiments conducted in the Bureau of Entomology, Department of Agriculture, Washington, D. C., showed that, when combs were subjected to the fumes of the gas for 48 hours in a Novy anaerobic jar, all germs of the disease would be destroyed; but as the average beekeeper could not have the requisite facilities, skill, and knowledge to carry on such work, he had better not take his chances of transmitting any infectious disease through combs fumigated under conditions such as he is able to provide. In all probability the work would not be complete enough to make disinfection sure. If any infection at all were left, the disease would spread again, and so the work might just as well have not been done—or not attempted; because melting up the combs and boiling, or, better, burning up the frames, would remove all possible traces of disease.

FOUNDATION. See COMB FOUNDATION.

FRAMES. See FRAMES, SELF-SPACING, REVERSING, and HIVES.

FRAMES, SELF-SPACING. By these are meant frames held at certain regular distances apart by some sort of spacing-device, forming either a part of the frame itself or a part of the hive. Under SPACING OF FRAMES, elsewhere, and under EXTRACTING, we have discussed the distances that frames should be apart. Some prefer 1½ inches from center to center; but the majority, supported by the best of reasons, prefer 1⅜ inches. Self-spacing frames, then, are those that, when put into the hive, are spaced automatically, either 1⅜ or 1½ inches from center to center. Loose or unspaced frames differ from them, in that they have no spacing-device connected with them, and are, therefore, when placed in the hive, spaced by eye—or, as some have termed it, "by guesswork." Such spacing results in more or less uneven combs; and beginners, as a rule, make very poor work of it. The advocates of self-spacing frames

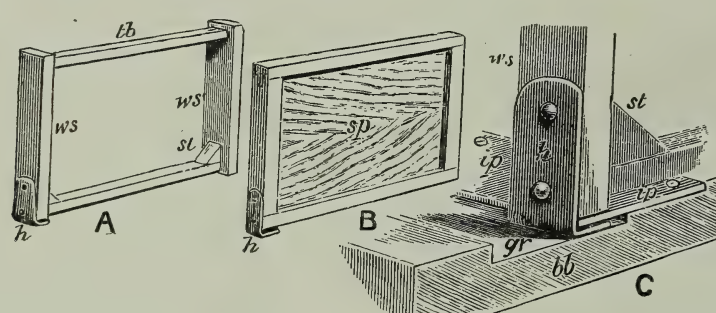
claim that they get even, perfect combs, comparatively few burr-combs, and that, without any guesswork, the combs are spaced accurately and equally distant from one another. Self-spacing frames are always ready for moving, either to an out-yard, to and from the cellar, or for ordinary carrying around the apiary. Loose frames, on the contrary, while they are never spaced exactly, often can not be hauled to an out-apiary, over rough roads, without having sticks between them, or something to hold them in place. It is contended by some, also, that spaced frames can be handled more rapidly. See FRAMES, MANIPULATING. On the other hand, the advocates of the loose frame urge, as an objection, that the self-spacers kill bees.

This depends. The careless operator may kill a good many bees. If he uses a little common sense, a little patience, applying a whiff or two of smoke between the parts of the frames that come in contact, he will not kill any bees. The fact that some of the most extensive beekeepers of the world are using self-spacing frames, and the further fact that the number of self-spacing-frame users is constantly increasing, shows that this supposed bee-killing is more fancied than real.*

There are a good many styles of self-spacing frames. We will describe, first, those most commonly used in this country and then show some of the others that are or have been used in Europe. Among the first mentioned we might mention the closed-end Quinby, the Danzenbaker, the Heddon, the Hoffman, the thick-top staple-faced, metal-spaced Hoffman, and the nail-spaced.

*When frames are handled but once a year as it is now the practice of some of the best beekeepers, all these objections lose their force.—A. C. M.

The closed-end Quinby is, as its name indicates, one whose end-bars are wide their entire length. The top and bottom bars are one inch wide. These closed uprights, or ends, when they come in direct contact, cause the combs which they contain to be spaced accurately from center to center. Fig. 1, A, shows one such frame. Several of the closed-end frames are made to stand, and have very often been called "standing frames." Mr. Quinby, in order to keep such frames from toppling over, invented the strap-iron hook on one corner, as shown in Fig. 1, re-engraved from Cheshire; *h* is the hook that engages the strap iron *ip* in the bottom-board; *gr* is a groove to admit of the hook, and at the same time render it possible to catch under the strap iron.



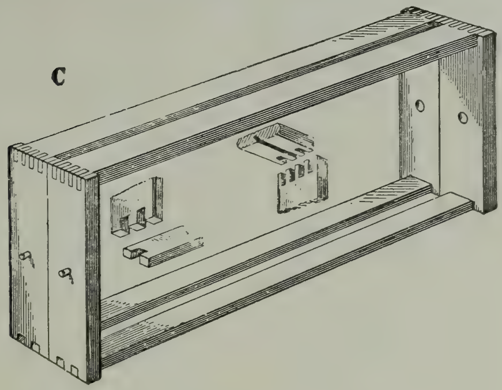
How the Quinby frame hooks on to the bottom.—*From Cheshire.*

These hooks are on the outside of the hive proper, and hence they do not kill bees, nor are they filled with propolis as they would be if made on the inside of the hive. A and B are respectively the frame and the follower, although they are drawn somewhat out of proportion. With a panel on each side, a cover and a bottom-board, the Quinby-Hetherington hive is complete, the ends of the frames forming the ends of the hive; although, for additional protection in the spring, Mr. Elwood and Mr. Hetherington both use the outside case to set down over the whole. This makes a very cheap hive, and has many desirable features in it. For fuller details in regard to this frame, and its manner of construction, the reader is referred to "Quinby's New Beekeeping."

DANZENBAKER CLOSED-END FRAMES.

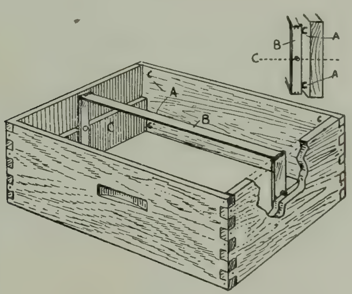
The closed-end frame which, perhaps, is to-day the most extensively used of any of its class in the United States, is the Danzenbaker, as described under HIVES,

and shown under FRAMES, MANIPULATING. The end-bars are pivoted at the center, the pins resting on hanger cleats secured to the



Danzenbaker closed-end frames.

ends of the hives. These pins make a very small line of contact, whereas the ordinary standing closed-end frame resting on tins secured to the bottom edge at the ends of the hive will crush a good many bees. They have the further advantage that, if there



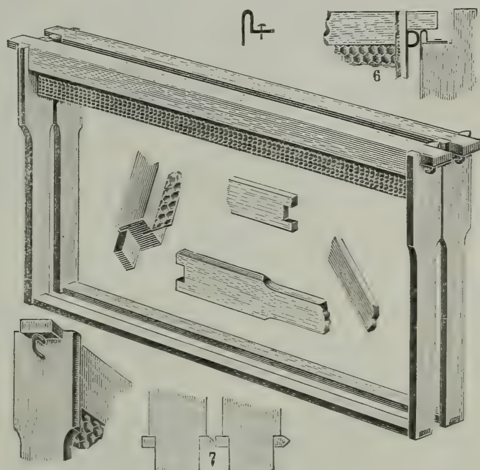
is any reduction in the depth of the hive due to shrinkage, the bee-space above and below the frames will be affected only half as much as if the frame were standing.

Many beekeepers prefer what is known as the "hanging frame." This has many very decided advantages over the standing frame; and there is no doubt that, for this reason, the loose frame is used so generally; but the hanging frame is also used as a self-spacing frame.

IMPROVED HOFFMAN FRAMES.

It will be observed that this frame can be used in an ordinary Langstroth hive (see HIVE-MAKING); and the end-bars are closed-end only a couple of inches from the top. The rest of the frame, two-thirds of the way down, is narrowed to $1\frac{1}{8}$ inches. The top-bars of the original Hoffman were made $1\frac{3}{8}$ in. wide with the middle scored out so as to measure one inch wide.

After having for a time Hoffman frames with top-bars widened at the end, we began the use of top-bars with the ends notched (see cut) and resting on the tin



Improved Hoffman frames.

rabbets, as shown in HIVE-MAKING. After years of use of the latter we much prefer them. The lateral movement is more easily effected, and there is very much less liability of bee-killing. Indeed, with proper care there need be practically none.

Another feature of this frame is the end-spacing staple that abuts against the tin rabbet shown at 6, in the cut. The ends of the top-bars are cut off so as to leave a bee-space around them. With the old-style frames the bees can sometimes glue the ends of the top-bars to the rabbet. This has all been done away with in the style shown.

When the top-bar is long enough to reach and almost come in contact with the ends of the rabbets, the bees will chink in bee-glue between the ends of the top-bars and the rabbets. After the ends of *all* the frames have been thus glued, it is somewhat difficult to remove any one comb, because the fastening of each frame must be loosened before the comb sought can be lifted out; but when the top-bar is shortened, as at 6 in the illustration, and the staple is used, there is none of this kind of gluing, the only fastening being that between the upright edges of the end-bars themselves; and this fastening, for the majority of localities, so far from being a

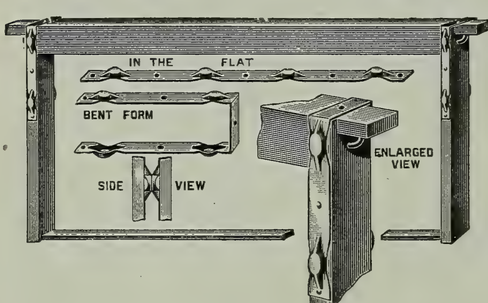
disadvantage, is helpful in that it holds the frames together while the hives are being moved, and yet does not hold them so as to prevent easy handling.

The Hoffman is the most extensively used self-spacing frame in all the United States, and there is even a possibility that it is used more generally than any other frame whether spaced or unspaced. Most of the hive-manufacturers supply it as a part of the regular equipment of their standard hives.

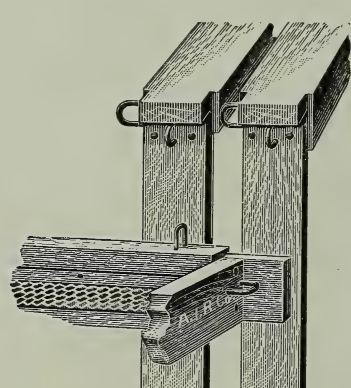
For details concerning its use, see Frames, How to Manipulate.

METAL-SPACED HOFFMAN FRAMES.

All that has been said in favor of the regular Hoffman will apply with equal force to the metal-spaced frame here shown. In some localities where propolis is very



abundant, sticky, and hard, the wooden projections of the regular Hoffman sometimes split off when the frames are pried apart. For localities where this condition



Staple-spaced frames.

prevails we recommend the metal-spaced, which can be used interchangeably with the regular Hoffman. The spacers on this new frame are stamped out of metal and must necessarily be accurate. The form of its construction in the shape of a letter U bending over the top-bar projection prevents the latter from breaking through careless handling.

STAPLE-SPACED FRAMES.

There are some others who prefer frames with staples for side-spacers, as here shown. Others use nails in place of staples; but the latter with their rounding edges allow the frames to slide past each other more readily.

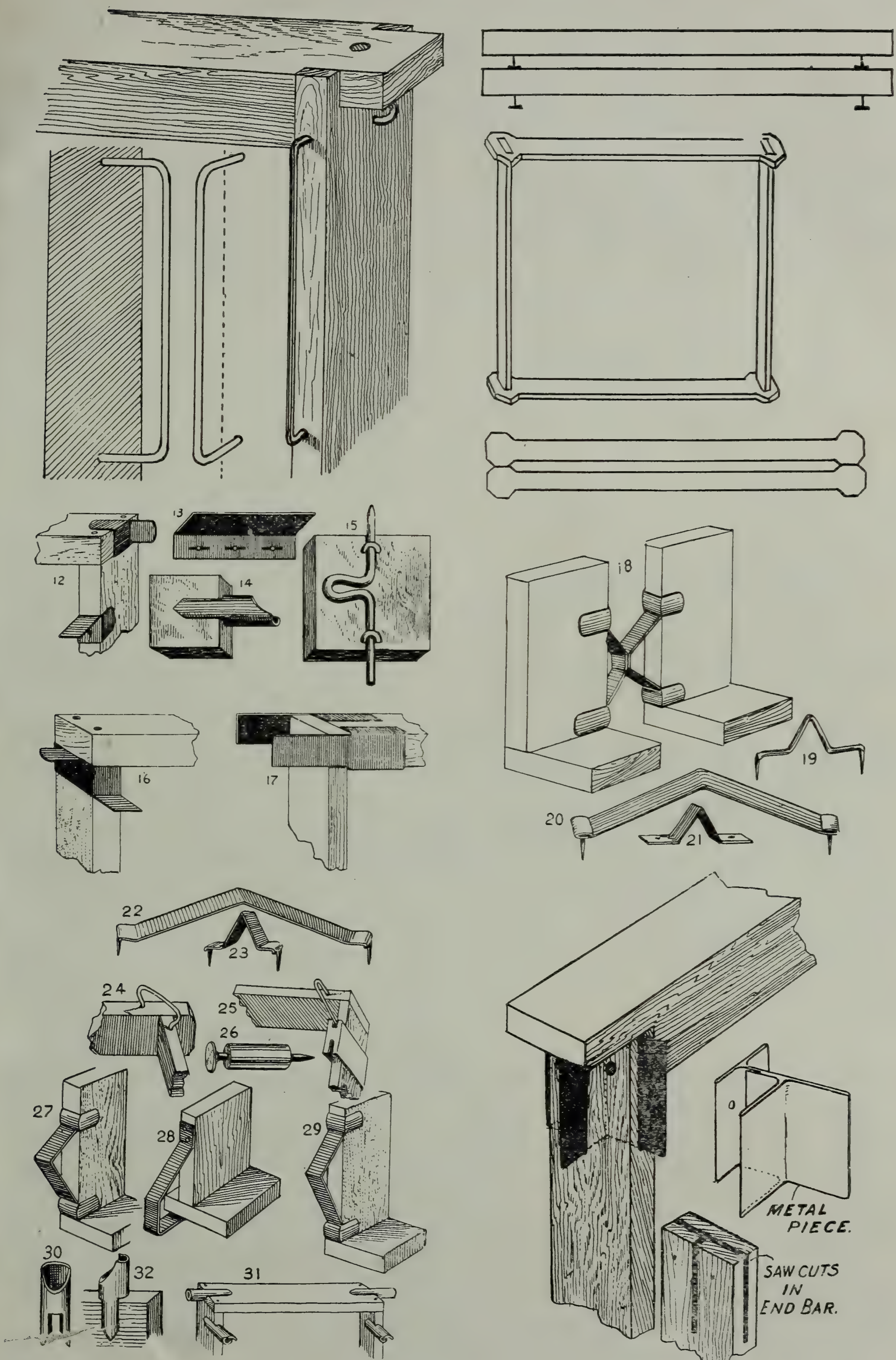
OTHER SELF-SPACING DEVICES.

Various spacing-devices have been suggested at different times. A few of these we present here, leaving the reader to judge of their relative merits. It will not be necessary to describe them in detail, as the engravings make plain their manner of construction and use.

It will be noted that there are two kinds of spacing-devices. One is made a part of the frame and the other a part of the rabbet. It would seem at first glance that the latter would be a very happy solution of the problem of automatic spacing, as it would leave the frames without projections in the way of uncapping; but the fact is, rabbet or hive spacers have never been very popular, and therefore are very little used. The principal objection to them is that one can not move the frames *en masse* or in groups, thus saving time in handling the brood-nest. The advantage of group handling is made more apparent under Frames, To Manipulate.

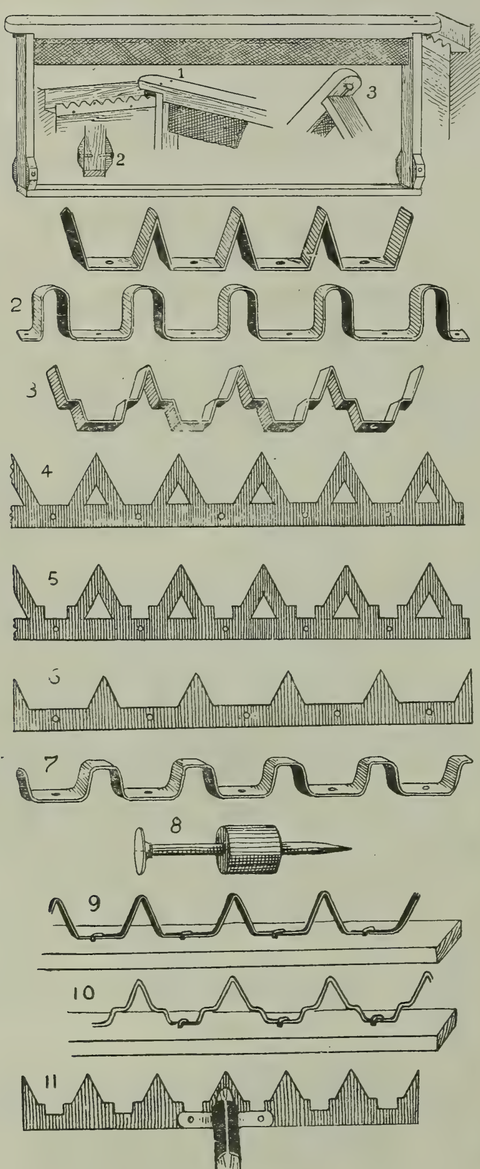
SELF-SPACING FRAMES—ADVANTAGES.

They give straight beautiful and regular combs; are practically free from burr-combs; can be hauled without any special preparation over the roughest roads, turned upside down, and rolled over without disturbing the combs. They permit, to a very great extent, the handling of hives instead of frames. Under Frames, Manipulating, is shown how they can be handled in pairs and trios—in fact, half a hive at a time. They can also be inverted, thus causing the combs to be built out solidly to the bottom-bar; and, when once completed, they can be restored to their normal upright condition. They can be handled as rapidly as the loose frame. Indeed, the late Mr.



Various forms of frame-spacers.

Julius Hoffman, of Canajoharie, N. Y., when owner of some 600 colonies on Hoffman frames, said he could work nearly double the number of colonies with his frame that he could with any frame not



Hive-rabbet spacers.*

spaced or close-fitting, and he had used both styles of frames. But not every one will be able to do this; and very likely some people would handle them much more slowly than they could loose frames.

*These are nailed on the side of or in the wooden hive-rabbet—the top-bars or frames resting between the notches or bends of the sheet metal or wire.

SELF-SPACING FRAMES FOR SMALL BEEKEEPERS.

Whatever we may say regarding the adaptability of Hoffman frames for the expert, we feel sure that, in almost every instance, they are better for the beginner, average farmer beekeeper, or any one who does not propose to make a specialty of the bee business, but desires to keep only a few colonies to supply himself and neighbors with honey. Such persons are apt to be a little careless, and, with ordinary loose unspaced frames, make bad spacing. It is seldom indeed that we have looked into the hives of this class of beekeepers and found their loose frames properly spaced. In some instances the combs are so close together that opposite surfaces are gnawed down to give the bees sufficient space to pass between; and in others they are so far apart that small patches of comb are built between; because it is an invariable rule laid down in hive economy, on the part of the bees, not to leave more than proper bee-spaces. Now, then, whenever the Hoffman frame, or any standard self-spacing kind, is used, we always find the combs properly spaced and combs perfect.

FRAMES, TO MANIPULATE. Before we proceed to the general subject of han-

dling frames, we will first consider the question of hive-seats and tools necessary

for the work. First and all important is a smoker (see SMOKER); next is some sort of hive-tool, which may be an ordinary screw-driver, a putty-knife with a stiff blade, or

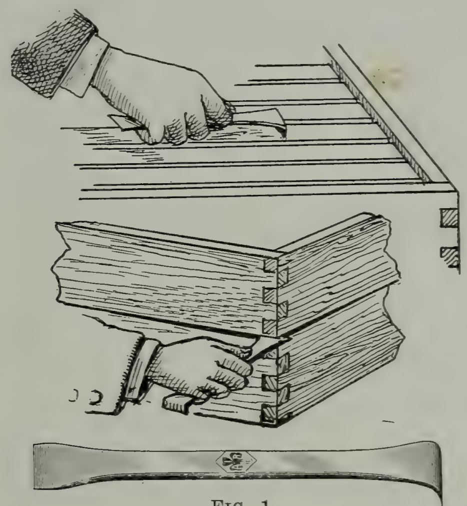


FIG. 1.

a special tool made for the purpose. The subjoined illustrations show a form of tool that has given general satisfaction among beekeepers.

It is something that any blacksmith can make out of an old buggy-spring or any good piece of spring steel. It must not be tempered too hard or it will break. Each end should be flattened out while hot, and brought to an edge. One end is bent to a right angle, and the other is left straight. The tool is then taken over to an emery wheel or grindstone and finished up. Care should be taken to have the edges *straight and square.*

The hooked end is ordinarily used for scraping propolis or wax off the frames or bottom-boards, while the other end (also useful for scraping) is pushed between the two parts of the hive; but the drawing shows the tool held improperly. The bent or curved end should be placed directly against the palm in order that sufficient pressure may be exerted to shove the other or straight end between the two hive parts.

Either end of the tool may be used for separating Hoffman frames, or, in fact, any style of frame that one happens to use; but our men prefer the hook end. This is inserted between the frames to be separated, as shown in Fig. 2, when a side

FIG. 2.—A side twist of the tool affords a strong leverage by which the frames are separated easily, and without jar.

FIG. 3.—Another method of using a hive-tool when prying the frames apart.

FIG. 4.—The proper way to pry all the frames over at one operation.

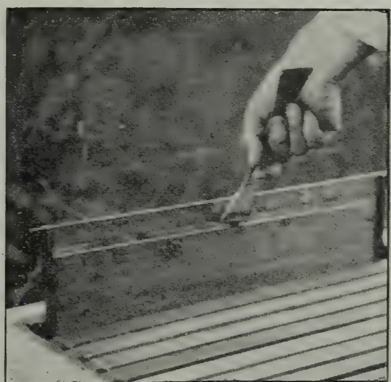


FIG. 5.—How the hook end is useful in fishing out frames and division-boards.

Fig. 6.—Making a gap between the frames so that one can be easily removed.

HOW TO WORK OVER HIVES.

Many yard men prefer to work with a sort of stool and hive box combined; yet others wish to have nothing to lug around except the bee-smoker and the hive-tool. As most hives are placed on or near the ground, one must either sit down on some object or kneel in front of the hive, to bring himself to the proper working distance. We usually use a hive-cover as shown in Figs. 6, 7, 8, 9. It is always handy and has the further advantage of a milk-stool in that one can shift his body back and forth on the hive-cover in order to reach frames toward the near or far side of the hive, as the case may be. A seat that does not allow one to shift his body back and forth, necessarily requires more stooping or bending of the back.

Fig. 7.—A comfortable position for all-day work. Note that the left arm that supports the weight of the frames rests comfortably on the knee.

twist of the wrist will exert considerable leverage, forcing apart the frames very gently. But there are some who prefer to use the straight end of the tool in the manner shown in Fig. 3; but the method given in Fig. 2 exerts more of a leverage, and, at the same time, is less liable to crush bees.

Fig. 4 shows how the tool may be used for crowding all the frames over to one side in one block, as it were; or one can, if he prefers, use the plan shown in Fig. 2; but it will generally be found that the one shown in Fig. 4 is more convenient. In Fig. 5 the curved end is used to good advantage in lifting the division-board out of the hive. See also, in this connection, Fig. 9.

Some prefer a hive-tool having a narrowed end like a screwdriver; but the continuous use of a tool like this abrases the edges of the hives so that, after a time, it leaves bruise marks and cracks, inviting winds and storms, and robbers when they are prowling about. For separating two hives heavy with honey there is nothing better than a *wide thin blade* made of good spring steel, tempered just enough to have the resilient qualitites of a buggy-spring.

Occasionally it will be found desirable to turn the cover up lengthwise, and we always use it in that manner when we desire to place the weight of the body against the frame that we are crowding over against its fellows. See Fig. 8. In pulling out a division-board, one has a little more leverage if he sits high rather than low. See Fig. 9. But if he merely wishes to sep-

arate the frames, then spend several minutes hunting for the queen or looking over the brood, as shown in Fig. 7, one should sit on the narrow side rather than on the end. In this the operator assumes a very natural, easy, and comfortable position. The left arm rests upon the knee, supporting

FIG. 8.—A higher seat is better when one wishes to place his weight against the frame to be shoved over.

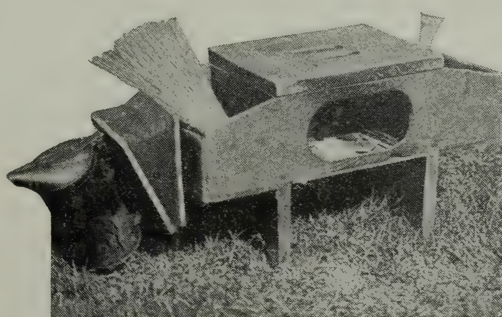
FIG. 9.—Pulling out a refractory division-board that resists removal.

the weight of the frame, while the right arm holds it in a position for examination.

A change of position is often restful. After one has been working over a number of hives, sitting down on the hive-cover or hive-stool, he finds it convenient to vary occasionally the position by resting on the knees close to the hive; and still again he may find it comfortable to vary the monotony by standing upright, bending over only when it is necessary to remove a frame.

Perhaps it may seem that the operator in Fig. 9 is taking things easy. There are times when only one hand can do good work. If one can assume a comfortable attitude, even though it be only momentary, he ought to do so.

We are well aware that some of our apiarists will say they have no time to sit down, much less "loaf on the job," as might appear in Fig. 6. It is our opinion, however, that the more one can save his legs and arms the more he can actually accomplish in a day. In hunting for a queen we can not afford to stand up on the job, but should get right down where the eyes can do their best work, as seen in Fig. 7, always holding the frame in such a way that the sunlight will strike it squarely. In looking for eggs this is very important, especially if the operator is getting toward the shady side of life when eyesight is not at its best.



Hand seat and tool-box for yard work.

Where one is working over bees day after day, a special hive-seat is a great convenience. The illustration shows what we

have used in our bee-yard. It was shown in one of the early editions of this work, but was dropped out because we thought it of hardly sufficient importance to occupy space. During all the years that have intervened, our apiarists have seemed to find it very handy. In fact, they seem to consider it almost indispensable; so if you come to any one of our yards you will

FIG. 9.—Method of inserting the hive-tool under the cover; blowing smoke in the gap thus made.

find the men carrying one around as they go among the hives. The top is made of 7/8 lumber, having two oblong holes in the center to provide a handle by which to carry the box. The legs are also of 7/8, while the sides, ends, and bottom are of 3/8. The compartment in the side, reached by the oval hole, is very handy for holding broken section pieces for record work, and other small articles, while the two compartments on each end usually hold the smoker fuel, hive-tools, hammer, bee-brush, queen-cages, and other articles of like nature. The smoker has a hook on the bellows so that it can be carried in the manner shown. With this whole outfit one has practically all the tools he needs, including smoker fuel, for a day's work.

The exact dimensions of the seat are not important. The one we use is 13 inches high by 22 long, outside measurement.

HOW TO OPEN A HIVE.

Having considered the necessary tools and appliances for working with bees as well as the manner of sitting or standing over the hives we will now turn our attention directly to the method of handling the frames themselves. Approach the hive that is to be opened and blow a little smoke into the entrance. This latter procedure is not always necessary, but it will be found to be a very wise precaution on the part of a beginner. After he learns the individual temperament of his different colonies, and also discovers that on certain days, and certain times of days, the bees can be handled much better than others, he will of course use his judgment in the matter. If he has reason to believe that a colony would be irritable he should send two or three whiffs of smoke into the entrance. He will now push the screwdriver, or special hive-tool already shown, under the cover. He should do this very gently, working the thin edge of the blade between the two hive parts until the cover is raised about the thickness of the blade, but not wide enough to allow any bees to escape. Through the gap thus made he will blow three or four whiffs of smoke. He then shoves the tool a little further, increasing the gap, following it up with some more smoke. He now lifts or lowers the hand holding the tool so that the cover is raised an inch above the hive. The smoker is next set down upon the ground, when the cover is gently lifted off. Sometimes much more smoke will be required than others. If the atmosphere is a little chilly, or if it be immediately after a rain during a honey-flow, much more smoke will be needed than on a warm balmy day when bees are at work in the fields. If they are at all nervous the smoker should be brought into play again; indeed, at such times we would advise putting it between the knees, as shown in the illustration at the top of the next page. See SMOKERS.

This nervousness may not immediately be recognized by a novice; but for his

special benefit we may say that, when bees are subdued and require no more smoke they will be down between the frames almost out of sight; but if they are inclined to "resent the intrusion," dozens and dozens of them will have their heads sticking

FIG. 10.—Holding a smoker between the knees while manipulating frames.

up; and as the apiarist proceeds to lift out a frame he may meet with a "warm reception." But before this takes place he will usually see on the part of the bees a nervous, quick movement, their bodies turning either to the right or to the left, apparently ready to take wing. When they do so, it will be a quick sharp dart, without warning, for any exposed part of the beekeeper's anatomy. But even if the bees do make a general onslaught, and grab as if about to strike, the sting may be averted if the operator is quick enough to brush the bee or bees off. There is an interval of a fraction of a second, not very long it is true, in which, after the bee shoves its claws into the flesh, that it can be brushed off, before the sting gets into action, for a bee, when it stings, must have a good strong hold, and it is while it is taking this hold that the apiarist can often save himself many a wicked jab.

If, then, the bees seem inclined to fly up, smoke them just enough to keep them down. If an attendant is present, let him use the smoker while the operator proceeds to handle the frames.

HOW TO HANDLE UNSPACED FRAMES.

To get at the center frame, crowd the frames, one at a time, adjacent to it, toward the sides of the hive. This will give room to lift out the desired frame. Beginners are very apt to pull the frame out without spacing the frames apart. This rolls the bees over and over, enrages and maims them, besides running a pretty good chance of killing the queen. Lift the frame out carefully, and be careful not to knock the end-bars against the sides of the hive. If it is one's first experience he may be nervous, and do things a little hurriedly. As a reward, the bees will quite likely sting him and make him still more nervous. To avoid this, proceed very cautiously and make the movements deliberate. Having removed the frame, hold it up as shown in Fig. 1, which we will call the first position.

Perhaps the queen is not to be seen on this side, so it may be necessary to turn it over and see the other side. If the comb is not heavy with honey, it can be turned right over with the bottom-bar resting horizontally. But a better way and a good habit to fall into, and one that beekeepers usually adopt, is to raise the left hand until the top-bar is perpendicular, as shown in Fig. 2.

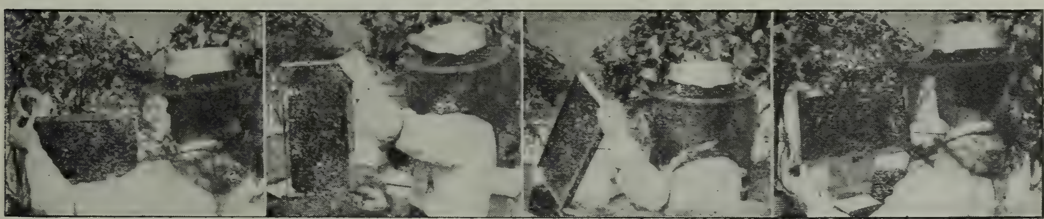


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

Now revolve the frame like a swinging door, or the leaf of a book, so that the opposite side is exposed to view (see Fig. 2). Lower the left hand as in Fig. 3 until it reaches the position as shown in Fig. 4. To examine the other side follow the exact reverse order.

E. D. Townsend illustrating for beginners the proper use of smoke in opening a hive.

Having examined this frame, lean it up against the side of the hive, and remove another frame next to the one already taken. Examine this in like manner. Lean this also against one corner of the hive, or return it to its place; lift out another, and so on until all have been examined. Now, should the queen not yet have been found, look the frames all over again, being careful to examine the bottom edge of the combs. See QUEENS, sub-head "How to Find."

If the queen is not found on the first examination it may be advisable to go over the frames once more; but very often it is better to close the hive and wait an hour or two, after which we can go back and search the frames as before. By this time the colony will have recovered itself, and the queen, in all probability, have shifted her position from the bottom or sides of the hive to one of the combs. Nine times out of ten she will be found at the second going-over of the frames, without any trouble. When the queen can not be found the first time going over, as a rule we would not advise hunting longer, because one is liable to waste a good deal of valuable time; and it is, therefore, better to wait till the queen comes out of her hiding place back to the brood-frames themselves.*

In the case of black colonies, especially where very populous, it is sometimes necessary to lift the hive off the stand and put it down at one side. On the old stand place an empty hive, affixing an entrance-guard. See DRONES. Now take the frames one by one out of the old hive, and shake them in front at the entrance of the empty hive on the old stand. Black bees fall off very readily; and as they crawl toward the hive the queen can be easily seen; but if she eludes scrutiny she will be barred by the perforated zinc, so she may be readily discovered trying to make her way through. After all the frames are shaken, if she can not be found, take the old hive, now empty, and dump it, causing the bees to be thrown before the zinc. She will soon be seen trying to pass the guard.

We have told how to find the queen; but do not imagine that it is going to be as difficult as this every time. She is usually to be found on the center frames; and especially with Italians she will likely be found on the first or second frame handled.*

When we put back loose frames we must space them carefully, $1\frac{3}{8}$ in. from center to center. We may fail to do it exactly, but try it the best we can. With loose frames we shall be obliged to space each one in position individually. If we do not space our frames carefully we shall have some combs bulged, and some thinned down; and, again, between others bees will be likely to build spurs of comb. All this nuisance may be avoided by the use of fixed frames or the Hoffman, which we now tell how to handle.

HOW TO MANIPULATE HOFFMAN FRAMES.

The manner of opening hives containing the Hoffman or any other self-spacing frame is precisely the same as that for hives of loose unspaced frames already described; but the manner of handling the combs is somewhat different.

With the hive-tool we pry apart the first pair or trio of frames, if the combs are not too heavy, and lean them against one corner of the hive as shown on next page. In so doing we pretty nearly handle the brood-nest by halves and quarters.

We shall discover that these frames are held together by propolis, and that the bees on the two inside surfaces are hardly disturbed. Loose frames, on the contrary, when out of the hive, must be leaned on one or two corners of the hives, against each other—in fact, be scattered all around, inviting the depredations of robbers. This is quite a point in favor of the Hoffman frame. If we do not find the queen on one of the combs, we next pry off the outside frame of the trio leaning against the corner of the hive. If she does not appear on that one, we pry off the next, and so on.

Where combs are heavy with honey we may lift out only one frame. Having seen the surfaces of two or three combs, the practiced eye will get a very fair idea of the condition of the colony and what the queen is doing. When we see eggs and

*If the bees are inclined to rob use an empty body to hang half of the frames in, placing them in pairs, and pair-off the rest in the hive being worked on.—A. C. M.

*Look where the queen *ought to be,* i. e. on combs containing fresh eggs, and generally she is there. By this simple scheme experts often find queens within one or two minutes after the cover is off and do it right along—but not so rapidly with the blacks.—A. C. M.

larvæ in all stages, including sealed brood, we do not usually stop to hunt up the queen; accordingly we put back the second pair removed, and return the trio, as shown. We do not generally crowd these frames together at once, but blow a little

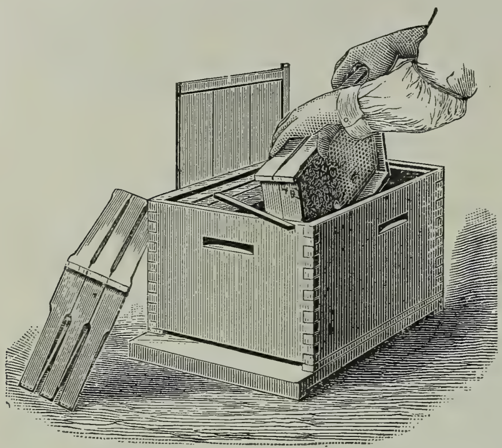
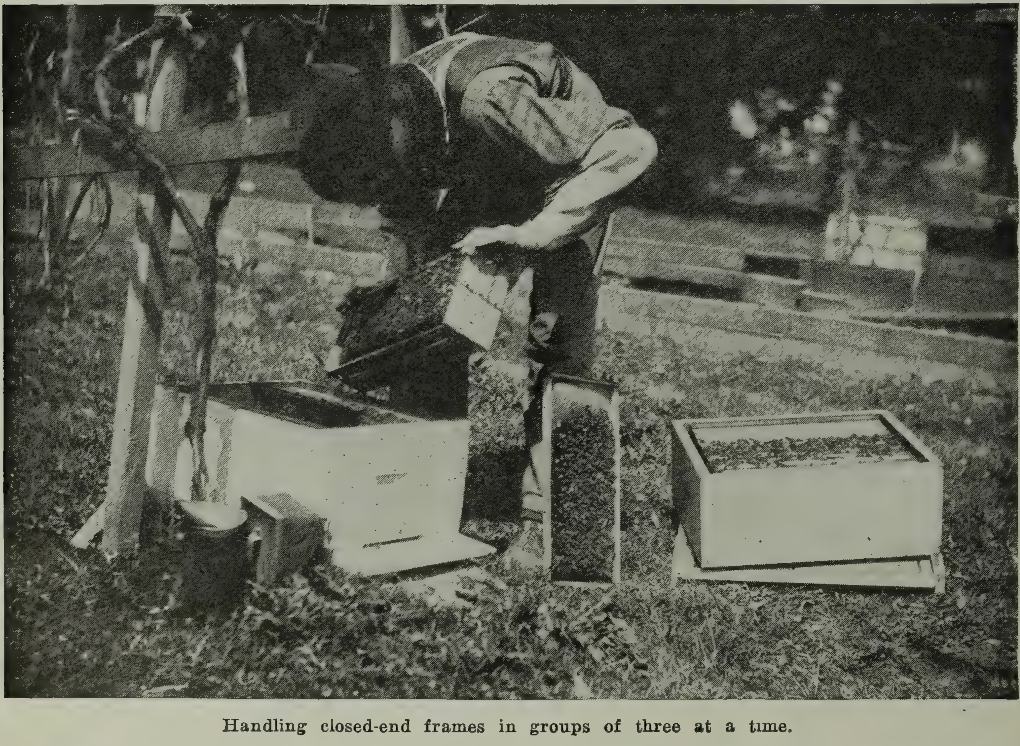


FIG. 5.—Handling Hoffman frames in pairs and trios.

smoke down between the end-bars, and then with a quick shove we close them all up again.

There is no cut-and-try spacing as with loose frames—no big and little fingers to get the distances at wide and narrow spaces. There is no need to instruct the beginner just how far to space combs, and there is no finding the apiary afterward, with any of the combs spaced so far apart that spurs of comb are built where they ought not to be. With the regular Hoffman frames the spaces must necessarily be exact, so the combs may have a fixed and uniform thickness; and we do not hesitate to say that one can alternate them just as well as or better than he can many of the loose or unspaced frames. We will explain. Space the loose frames during the honey-harvest, anywhere from $1\frac{3}{8}$ to $1\frac{1}{2}$ or even $1\frac{3}{4}$ inches from center to center, and then, after the honey-harvest, try to alternate them with other frames spaced a little closer, and see where you are. You may say you can space frames near enough right. Although we have visited many large apiaries, we seldom see a loose-frame apiary spaced correctly.

To go back, we will replace the follower, and crowd the frames tight together. If there are any bees on the tops of the frames, a whiff of smoke will usually drive them down and then the cover is replaced with a sliding motion, which we have already explained.



Handling closed-end frames in groups of three at a time.

About to insert a Danzenbaker frame in place from which it came.

Perhaps from the description about manipulating the hive with Hoffman frames, it may appear like a long operation; it is a very short one. Mr. Hoffman said he could handle nearly double the number of colonies on his frame that he could on any loose frame; and we will add right here that he used loose frames for years, until necessity, the mother of invention, caused him to bring out this style.

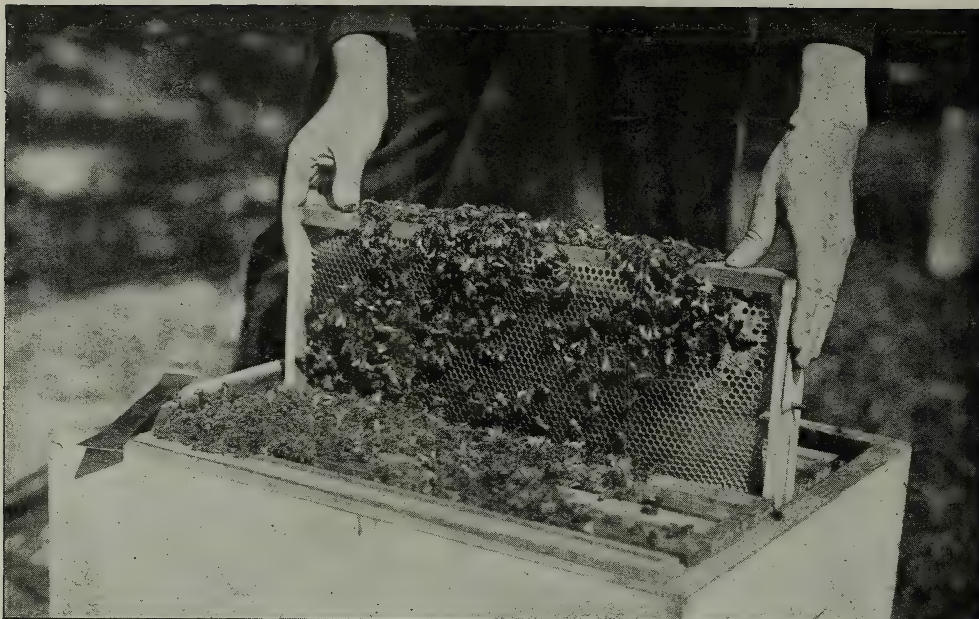
There is another good feature; namely, by removing two or three frames in a trio, the rest of the combs in the hive need not be lifted out. They can be slipped back and forth, and each surface examined; but if the tin rabbet is covered with pieces of propolis, this lateral sliding is not easily accomplished.

There are some localities where propolis is much worse than in others. In such places the Hoffman frame is not as satisfactorily used as the staple-spaced shown in FRAMES, SELF-SPACING. With perhaps one exception this can be handled like the Hoffman; and that exception is that it can not be handled in pairs or trios. Each comb must be manipulated individually. In this respect it is quite behind the Hoffman.

HOW TO HANDLE DANZENBAKER FRAMES.

As shown under HIVES, the frames are pivoted in the center, and rest on hanger-cleats in the ends of the hives. When opening up for inspection, keep the frames together in one solid body, without any spaces between them. It is not advisable to loosen all the frames with a screwdriver at the start. Break the propolis connections only on the frame or frames to be handled, leaving the rest glued together so they can be lifted out in blocks of two, three, or four, as shown. If it is desired to examine the comb surface of one frame, break the propolis connections on each side of it, as before explained, and pull it out as in cuts here shown. Usually the examination of the brood in one frame will suffice to give to the practiced eye some idea of the laying capacity of the queen, of the amount of brood in the hive, and the amount of stores.* If it is necessary to examine another frame, set the one first taken out down by the side of the hive; loosen another frame, and remove that. In this way all the frames in the hive can be examined; but when the frames are reinserted, if the end-bars are covered with bees they should be slipped back into place *by sliding the edge of one end-bar against another,* beginning at the top, and working downward. By so doing the bees are pushed

* A close student soon learns to determine this by a look at the tops of the frames. The way the bees are spread and behave tells all he needs to know.—A. C. M.



Sliding a Danzenbaker frame down between two others.

or shoved out of the way without crushing or pinching. With a little practice and experience this can be done without killing a single bee. When all the frames are in place except the last one, there will be a space just wide enough to admit it. Slide it into position, pushing the bees off the end-bars on both edges at once.

Be careful not to get the frames loosened up so that they will tumble over against each other in a bad mix-up. If they are separated about two or three inches apart they are so nearly on a balance they will topple one way and the other. The bees will naturally crawl between the upright edges of the end-bars; and now to crowd

Method of grabbing Danzenbaker frame when removing it from the hive.

Dr. Miller's method of jarring bees off the combs.

the frames all together with a slam would smash the bees by the scores, and at the same time anger them into stinging fury.

How to bump the bees off a comb.

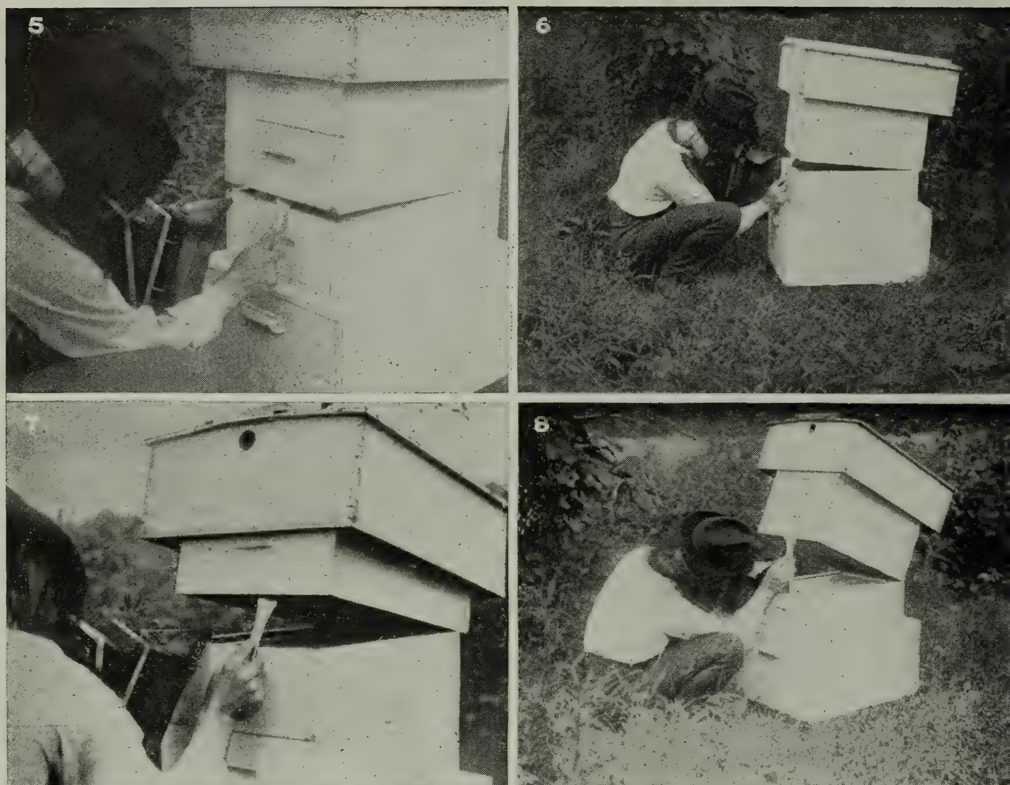
Bear in mind that Danzenbaker frames must be kept together in groups of twos and threes. Never let one frame hang by itself on the pin supports. It is important to remember, also, that when they are all in place they must be shoved up together tight without any spaces between them.

For many manipulations like giving brood to another hive, or for the purpose of extracting, it becomes necessary to dislodge the bees from the frames. This can be done by brushing them off as shown under Extracting, or they can be pounded off with a blow of the fist on the back of the hand, grasping the end-bar as shown.

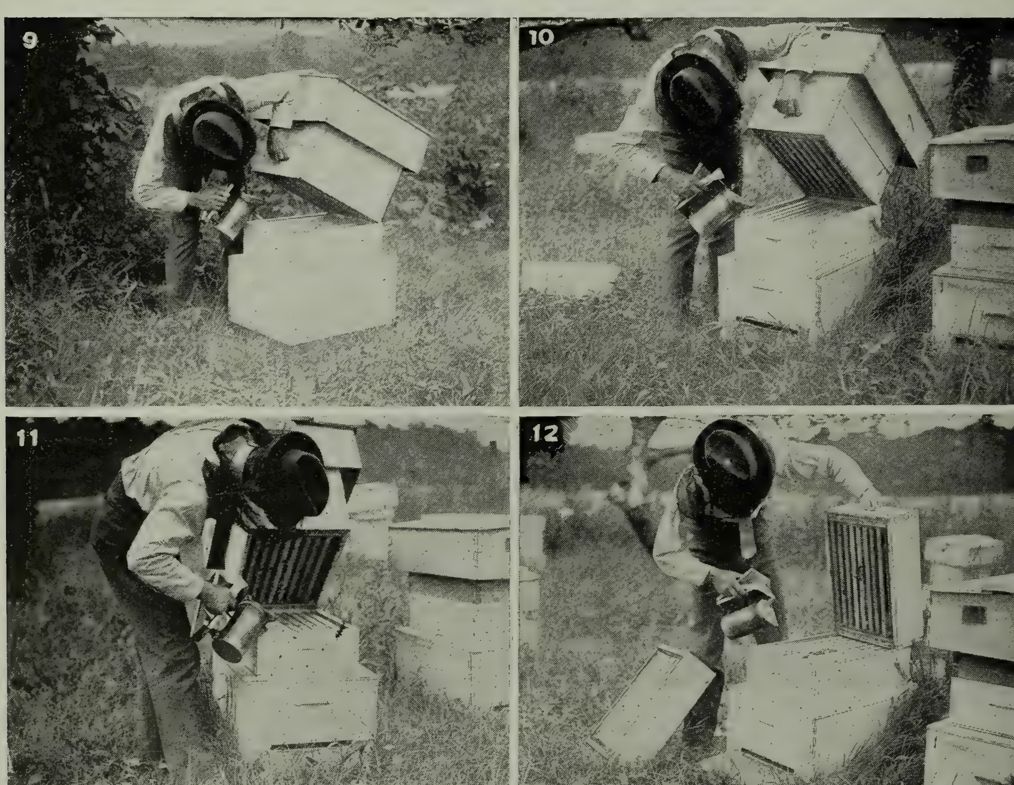
Or one may grasp the end-bars of the frame solidly, and with a quick downward jerk remove all or nearly all of the bees. When more convenient one can swing the frame, pendulum fashion, with one arm, letting the corner drop violently against the ground while the other end is held in the hand. See Hives, also Extracting.

HOW TO ASCERTAIN THE CONDITION OF THE HIVE WITHOUT HANDLING FRAMES.

A good many, in working for extracted honey, operate on the tier-up principle, leaving the supers all on the hives until the season is over. By that time it is im-



Learning condition of hive without removing cover or pulling to pieces.



Determining the filling of the supers and whether ready to come off.

portant that robbers be given no opportunity to help themselves to sweets, when the honey is taken off; but before doing so the condition of the supers should be determined in advance. In order to keep ahead of the bees it is necessary to make an examination from time to time. Toward the early part of the season it is customary to place the empty supers under those partly filled. As the season begins to draw toward its close, the process is reversed—that is to say, the empties are put on top of those partly filled.*

In order to determine the amount of honey in any super, it is not necessary to take off the cover and pull the hive apart. If it is tiered up four and five stories high, it involves a large amount of labor and considerable lifting to pull the supers off one by one, inviting the attention of robbers in the operation. If one is supplied with a good strong steel hive-tool and a smoker, he can get a fair idea of the filling of any super, without even removing the cover from the hive. In the series of snapshots shown herewith, the reader will be able to gather, almost at a glance, the exact method to be used in determining what the bees are doing.

Let us take an example. We will start with his hive shown in Fig. 5, opposite page. It has three supers. The middle one is the one on which the bees began work first, and at the time of this examination it should be completely filled. The bottom super was placed under after the middle one was about half filled. The third super was put on top because there would probably not be more than a week more of honey-flow.

At this time we desire to know what the bees have actually done; so, without removing the telescope cover on top nor the super cover directly beneath, we extend the thin blade of the hive-tool, broad end, between the two lower supers *at the back end of the hive;* for one should always endeavor to keep out of the flight of the bees. This is gradually shoved in until the blade has been pushed in anywhere from ½ to a full inch. A gap is now formed, of approximately 1-16 inch, just wide enough so that a little smoke will drive back the bees. A slight pressure downward separates the two upper supers about an inch at the back end, when more smoke is blown in. The tool is pushed down a little further, making the gap a little wider. See Fig. 6. But we are not quite satisfied as to the condition of the supers, so we push the tool and supers upward, as shown in Fig. 7, until we have the hive-tool in position as shown in Fig. 8. Here it acts as a prop, when, with the intelligent use of the smoker, we can drive back the bees enough so that we can see the condition of the two supers, or enough to determine whether the bees need more room.

But suppose we are not quite satisfied. We turn to the position shown in Fig. 9, disregard the hive-tool, and lift the two supers higher, the hive-tool falling on the ground. When doing this we slide the two supers about an inch forward so that the back end will fulcrum on a safe bearing. If the super is slipped back, as shown in Fig. 7, it can be readily seen that it can not be tilted up very high without sliding off back. See Figs. 9, 10, 11.

Usually an examination of this sort is quite sufficient. If the supers are not filled they are quietly let back into place, using sufficient smoke to drive the bees away so they will not be crushed as the hive parts come together again. The operation shown in Figs. 5, 6, 7, 8, 9, 10, 11, is then repeated with other hives, taking from 30 to 60 seconds per hive. At no time have we lifted but a part of the dead weight. When the supers are held at an angle the load is on the fulcrum point of contact, while the hand sustains only a small part of the weight.

Fig. 12 shows the method employed when supers are apparently well filled and ready to come off. The top super is removed and leaned up against the leg of the operator. The middle super that has been filled can now be taken off; but before doing so a second examination is made as shown. It is set off, when the bottom super may also be removed if ready. If so, the top super is put back, the idea being to confine the bees to as small a super capacity as possible as the season draws to a close, in order to make the bees finish their work.

* A few beekeepers have for some time been very successful in giving all supers at the beginning of the season and if they err as to number they try to have it on the side of giving more than the bees will fill.—A. C. M.

FIG. 14.—Shaking bees out of a super.

FIG. 13.—How a smoker and a hive-tool will enable one to learn the condition of the supers at one glance.

Fig. 13 shows a slightly different pose from that indicated in Fig. 8. While the position of the operator is somewhat cramped, it is true, yet it is much easier than tearing down the hive, super by super, and replacing the same.

In Fig. 14 we have a case where the season is closing abruptly. The bees have only partially begun work in the top super. To leave it on would mean that all the supers would have honey in, and none of them quite completed. Accordingly we shake the bees out of the top super, place a thin super cover on the two lower supers, place the super just shaken on top, and the regular cover on it. The hive is now left until we can determine a little more about the season. If there should be some good rains and warm weather, the season may take another start. In that case the super cover that was placed between the top super and the two below is removed, when work will be resumed in the third super. If we were sure that the season was drawing to a close, the top super should be removed in the first place.

HOW TO PUT ON ESCAPE-BOARDS.

In going through bee-yards we have noted the fact over and over that some bee-keepers have an awkward way of putting

Apple-blossoms.

on escapes. They will pull the hive apart, super by super, place the escape on the brood-nest or on a super partly filled, then one by one put back the supers. If no honey is coming in, this will probably mean that robbers will get started.

There is no need of removing any super, nor a cover, for that matter. All that is necessary is to apply the principles illustrated in Figs. 5, 6, 7, 8, 9, 10, 11. See also illustration under COMB HONEY, showing how to put on an escape-board.

FRUIT-BLOSSOMS. In the northern portions of the United States, where much fruit is grown, especially apples, pears, and peaches, there will be an occasional spring when quite a little honey is gathered from the blossoms. Nearly every season fruit-trees yield a little honey, if not too cold, just when it is most needed to stimulate brood-rearing; and although the bees may not store much, they will gather enough to give the whole apiary a new impetus, so that, where fruit is grown extensively, beekeepers often receive considable benefit.*

As to its quality, the honey from fruit-blossoms is among the very best. It is light in color, of good body, and in flavor not unlike the beautiful aroma one enjoys when going through an orchard in full bloom. Such honey, if it could be gath-

* Huckleberries and blueberries, flowering about the same time, usually yield heavily; and where these and orchards are both near to the apiary the crops secured in good weather are large.—A. C. M.

ered in sufficient quantities, would doubtless have an extensive demand; but it is very seldom that bees are able to get enough to store any in the supers or sections.

SPRAYING DURING BLOOM DESTRUCTIVE TO BEES AND BROOD.

Now that spraying with various poisonous liquids has come to be almost universal among fruit-growers, the question arises, "Shall such spraying be done during the time the trees are in bloom, or before and after?" If it is administered when the petals are out, bees are almost sure to be poisoned, much brood will be killed, and many times valuable queens are lost. About the first thing one notices during fruit-blooming time, if trees are sprayed while in bloom, is that a good deal of the brood dies, until the beekeeper begins to wonder whether his bees have foul brood, black brood, or pickled brood—unless the truth dawns upon him that they have been carrying in poisonous liquids from the trees that have just been sprayed. Experiment stations all over the United States have shown that it is quite useless—indeed, often decidedly harmful to the young fruit —to spray during the time the trees are in full bloom; and they have shown over and over again that just as good and better results can be secured by spraying both *before* and *after* blooming, when there is no danger of bees visiting the trees in quest of pollen and nectar. Some experiments that were conducted at the Cornell and Geneva experiment stations, New York, are particularly conclusive in showing that to spray in full bloom is decidedly injurious to the blossoms themselves, to say nothing about the great damage done to the beekeeper. The poison as ordinarily used is very harmful to the growth and development of the pollen. Again, the delicate organs of the flowers (stamens and pistils) are either killed or injured. Some of the pollen in the experiments above mentioned was taken into the laboratory and mixed with a thin syrup of about the consistency of raw nectar, and to this was then added a quantity of the spraying-liquid of the strength that is ordinarily used on fruit-trees. In every case it was found the pollen failed to develop. In short, those in charge of these experiments gave any amount of proof to the effect that, irrespective of any interests of the beekeeper, the fruit-grower himself *could not afford to spray during fruit-blooming time, because spraying-liquids that are sufficiently strong to kill insect pests are decidedly harmful to the delicate reproductive organs and to the pollen of the flowers themselves.*

Some prominent fruit-growers who once were of the contrary opinion, and who sprayed during full bloom, have since found their mistake to their sorrow. In some instances they confessed to losing nearly one thousand dollars.

Some spraying-fluids are not poisonous, as, for example, the lime-sulphur washes, the kerosene, and other emulsions of crude oil; but even these should not be sprayed when the trees are in bloom. Hellebore, or any of the Bordeaux mixtures, especially if they contain Paris green, or any of the arsenites, will be poisonous, of course; but such fluids are also too strong for the delicate pistils and stamens of the flower.

Spraying is practiced to kill the fungi and injurious insects. The codling moth that is responsible in the main for wormy apples lays its egg in the bark of the trees.* As soon as the larva hatches, it seeks out the blossoms about the time the petals fall and begins to burrow into them. If they have a coating of poison it dies before it can do any mischief. Otherwise it makes its temporary home in the maturing fruit.

THE STATEMENT OF A HIGH AUTHORITY IN FRUIT CULTURE.

"The American Apple-orchard" is the title of a book by F. A. Waugh, published by the Orange Judd Co., of New York. It contains over 200 pages of interesting and valuable matter. Price $1.00.

Those fruit-growers in the vicinity of our beekeeping friends, who insist on spraying at the wrong time in spite of the advice of experiment stations all over the United States, and up-to-date fruit-growers, should be shown a copy of this work. If they are so behind the times as to spray while the trees are in bloom they have a lot to learn, and it would be dollars and

* There are several broods in a season. The eggs producing the first one are mostly laid in the cup at the blossom end of the fruit (the calyx) hence the desire of the growers to spray as soon as possible after the petals drop. The calyx closes in a week to ten days; and if the poison is not in before that the young grub will be safe.—A. C. M.

dollars in their pocket to purchase a copy of this work and read it carefully. We are not sure but that beekeepers can afford to buy it and loan it out to their fruit-growing neighbors. We copy a portion of chapter 11, entitled "The Insect Campaign." Under the head of "Codling Moth," the worm* that so often turns one's stomach as he bites into an apparently sound apple, he says:

This is one of the best known and most widely distributed enemies of the apple. Newly settled districts have nearly always enjoyed a temporary immunity from this pest, but experience has shown that the moth can not long be kept out of any commercial apple-growing district. Apparently the ravages of the codling moth are more serious in central and southern latitudes, where two or three, or even as many as four, broods are hatched in a year. However, the campaign against this insect is an annual one, and has to be fought in practically all the commercial orchards in the country.

The principal preventive of damage is the spray-pump, using poison sprays. Paris green is largely used at the present time, but is being generally supplanted by lead arsenate. Thorough spraying at the right time with these insecticides will very greatly reduce the percentage of damage. Indeed, in many cases the work of the insect is practically eliminated. As in dealing with every other insect or fungous pest, thorough spraying at the proper time is highly essential. The proper time in this case is within one week to ten days after the falling of the blossoms. A longer delay can not be made with safety. After about 10 days the calyx, or blossom leaves of the young apple, close and the apple turns to a pendant position. Before this time the newly set fruit stands erect with the calyx lobes open. A poison spray properly distributed falls into this calyx cup and the poison lodges there. As many of the young larvæ enter the apple by eating in at this blossom end they secure with their first meal a taste of poison which usually prevents any further apple-eating on their part.

Special attention should be called to the fact that apple-trees should not be sprayed while in blossom. Spraying at this time is not always totally without value, but in many instances it is not only unnecessary, and even highly dangerous to the crop. Under all circumstances it is very likely to poison the bees working on the apple-blossoms. This sort of damage is far-reaching in many cases; and as the bee is one of the fruit-grower's best friends we can not afford to murder whole swarms in this way.

This early spraying, just after the blossoms fall, will not usually catch quite all the codling moth, even all the first brood. When the second or third brood hatches later in the year a still smaller percentage can be poisoned by the arsenical spray; nevertheless, it pays to give additional sprayings for this purpose in case the second and third broods appear to be large.

Note the special paragraph in italics, which are ours.

The average manufacturer of spraying-outfits usually gives directions for making the spraying liquids; and so far as we know there is only one who advocates spraying when the trees are in bloom. We respectfully suggest that our readers investigate very carefully, and be sure that they do not buy from parties who give such advice. We do not usually advocate the boycott, but we do think in this case that it is entirely proper to—*buy of the other man.*

*Half a worm will turn it quicker.—A. C. M.

Benjamin W. Douglass, formerly State Nursery Inspector for Indiana, and now editor of *The American Horticulturist,* on the question of when to spray, says:

The first spraying should be applied before the buds open, at a time when the bees are not interested in the trees in any way. The second spraying comes *after* the petals have fallen; also a time when the bees are no longer interested in the orchard. Bees attend very strictly to their own business; and after the nectar has dried up in the flowers they are a dead issue so far as the honey-gatherers are concerned. It is the second spraying that usually causes the fight between the orchardist and his beekeeping neighbor. Very often the neighbor will become alarmed as soon as he sees the spray-machine at work, and in some cases he will claim that every dead bee that he finds for weeks to come was killed by the arsenite spray.

A NEW SPRAYING SOLUTION THAT IS REPELLENT TO INSECTS.

During the last two seasons a new spray material has come into very general use over the country. This is the dilute lime and sulphur solution as a substitute for the old Bordeaux mixture. The Bordeaux was simply a mixture of copper sulphate and lime, and it was used in connection with the arsenate of lead or with Paris green. The new sulphur spray requires the addition of the arsenic, just as the Bordeaux did; but it possesses the added advantage to the beekeeper that it is repellent to all insects. The smell of the sulphur is so strong that trees sprayed with it are notably free from insects of all sorts during the period through which the smell lasts. In this way the bees are repelled along with certain injurious insects (notably the plum curculio). This repellent action of the lime and sulphur will no doubt go a long way toward easing the fear of the beekeeper. For my own part I feel so sure of the repellent value of the sulphur that I will venture the assertion that no harm would result to the bees, even if the orchard should be sprayed while in full bloom.

C. E. Layman, of Troutville, Va., in an article in *Gleanings in Bee Culture,* March 1, 1911, says:

I have had a great deal of experience in the spraying of fruit, and have watched some of my neighbors frequently who persisted in spraying while trees were in bloom, and in nearly every instance their fruit was damaged more or less, while my trees, which had not been sprayed until after the bloom dropped, were full of perfect fruit. There can not be any doubt about this point in my mind, as has been so thoroughly demonstrated in this section.

In a number of States, laws have been enacted making it a misdemeanor to spray during blooming-time; but there are many ignorant fruit-growers—stubborn as well—who persist in administering the poison-

ous mixtures to the very flowers from which bees are gathering pollen and nectar. The result is, many bees are killed, also a great deal of brood. The only thing that can be done when there is no law in force is to labor with neighbors and friends who may be ignorant of or indifferent to the rights of others. Show them that the use of arsenites during the flowering of the trees is both a waste of chemicals and time, and a very great damage to the bees and to the beekeeper, if not a menace to human beings who might eat honey tinctured with the poisons that bees gather from the trees. Much more can be done through moral suasion than by big talk and bluff, threatening suit for damages.

AGENCY OF BEES IN POLLINATING FRUIT-BLOSSOMS.

At various times beekeepers and fruit-growers have come into conflict, the latter affirming that bees puncture ripe fruit, besides interfering more or less during its packing; and the consequence is, that beekeepers have in some cases been asked to remove their bees, on the plea of their being a nuisance.* But fruit-growers little realized that they were trying to drive away the agency necessary to the proper pollination of fruit-blossoms. We are happy to say, however, in later years the two factions are beginning to realize that their industries are mutually interdependent. If any thing, the fruit-grower derives very much *more* benefit from bees than the beekeeper himself; for it is now known, as we shall presently show, that certain kinds of fruit not only depend very largely for their proper development upon the agency of the bee, but in many instances will fail to come to fruitage at all without it. Some years ago a beekeeper in Massachusetts was obliged to remove his bees to another locality, on complaint of the fruit-growers that they were a nuisance; but after a year or two had passed they were very glad to have the bees back again, because so little fruit set on the trees in proportion to the amount of blossoms appearing. The beekeeper was recalled; and, as was to be expected, not only more fruit but more perfect fruit development followed.

It is also related that red clover, after being introduced into New Zealand, failed to bear seed. Finally bumble-bees were imported, and then there was seed.

In more recent years, very careful and elaborate experiments have been conducted by scientific men, as well as by beekeepers and fruit-growers together; and the combined testimony shows almost conclusively that the two industries depend more or less upon each other.*

Much has been written in the back volumes of *Gleanings in Bee Culture* on this question; but in the journals for January 15 and February 15, 1894, and again in March 15, 1912, there appeared symposiums in which a few of the facts are here given. It would be impossible for us to give space to the whole; and we will, therefore, refer to only a few paragraphs. It may seem almost unnecessary to give evidence of that which we already *know* to be true; but many a time ignorant prejudice on the part of fruit growers causes trouble, because they can not, or think they can not, afford to read the papers. Let the beekeeper present to them a few *facts and figures* and they will, if disposed to be fair, acknowledge their mistake.

Well, here are the facts: In *Gleanings in Bee Culture* for Sept. 15, 1891, there appeared a most valuable article from Prof. A. J. Cook, then professor of entomology of the Michigan Agricultural College (now Horticultural Commissioner for California), detailing the experiments that had been made at that place on the subject of flower-fertilization. He went on to say that, while there are solitary insects that help to do pollen scattering, the work they perform is infinitesimal as compared with that of bees, because, unlike the bees that live over winter, they are not present in early spring, when the fruit-trees are in bloom. After calling attention to the fact that it is important, by definite experimentation, that we learn just how necessary the bees are in the pollenation of plants, he says:

> I tried many experiments last spring. I counted the blossoms on each of two branches, or plants, of apple, cherry, pear, strawberry, raspberry, and clover. One of these, in the case of each fruit or each experiment, was surrounded by cheese-cloth just before the blossoms opened, and kept covered till the blossoms fell off. The apple, pear, and

* See BEES ATTACKING FRUIT.

* Under natural conditions blossoms and insects are fairly well balanced; but when man masses the flowers in countless thousands as in large orchards he must also mass the insects; and honeybees are the only insects which he can control.—A. C. M.

Apple trees in bloom in A. I. Root's orchard.

cherry were covered May 4th, and uncovered May 25th and May 19th. The number of blossoms considered varied from 32, the smallest number, to 300, the largest. The trees were examined June 11th, to see what number of the fruit had set. The per cent of blossoms which developed on the covered trees was a little over 2, while almost 20 per cent of the *uncovered* blossoms had developed. Of the pears, not one of the covered developed, while 5 per cent of the uncovered developed fruit. Of the cherries, 3 per cent only of the covered developed, while 40 per cent of the uncovered blossoms set their fruit. The strawberries were covered May 18th, and uncovered June 16th. The number of blossoms in each experiment varied from 60 in the least to 212 in the greatest. In these cases, a box covered with cheese-cloth surrounded the plants. The plants were examined June 2. Eleven per cent of the covered blossoms, and 17 per cent of the uncovered had developed. To show the details, in one case 60 blossoms were considered, 9 of which in the covered lot, and 27 in the uncovered, had developed. That is, three times as many flowers had set in the uncovered as in the covered. In another case of 212 blossoms, the fruit numbered 80 and 104. In a case of 123 blossoms, the number of fruit was 20 and 36.

Our experiments with clovers were tried on both the white and alsike. While the uncovered heads were full of seeds, the covered ones were entirely seedless. This fully explains the common experience of farmers with these plants.

In the symposium in 1894, the first article of the series was from J. C. Gilliland, who, in the summer of 1893, in a large field of medium red clover that came within 30 feet of his door, covered some blossoms with netting, and around others *not* covered he tied a small thread. During the following August he gathered seed from the covered blossom, and also some from the plants not covered; and by careful counting he found that the latter gave 21 per cent more seed. His experiments were repeated again, with like results. As bumble-bees visited the field very profusely that year, it seems pretty evident that the larger amount of seed came as a result of cross-fertilization by bees. But this only shows what bumble-bees may do. When it comes to the ordinary *honey*-bees, the per cent in favor of uncovered blossoms as against the covered is very much larger. Witness, for instance, the extract from Prof. Cook's article just given.

As to how bees pollinate buckwheat read this, from R. F. Holtermann:

During my visit to the Ontario Government Jordan Harbour Fruit Station I noticed a patch of buckwheat, partly enclosed to bar access by the bees and other insects. I at once judged that another long-hoped-for wish that the Ontario Government would carry on investigations in the

fertilization of blossoms by bees was beginning to take shape. No doubt the station's first report will be to the Minister of Agriculture, the Hon. J. S. Duff; yet that did not prevent me from adjusting my eye to a small opening available, and finding that the uncovered buckwheat had at least one third more buckwheat seeds than the covered. The horticultural official at my side, in response to my quick verdict, confirmed my opinion.

Mr. J. F. McIntyre, a beekeeper, and a delegate at the California State Fruit-growers' Association for 1893, reports that:

A gentleman stated that he had a friend in this State who started into fruit-growing several years ago, locating 35 miles from any fruit-growing section, or where any bees were located. The first year that his trees blossomed, and in expectancy of at least some returns from his orchard, what should be the result but complete failure! He was advised to procure some bees to aid in the fertilization of the blossoms. He did so, and since then his orchard has been productive.

The following item also appears in *Gleanings in Bee Culture* of March 15, 1912:

Mr. Terry, president of the Vermont Horticultural Society, in a recent public address said that in Grand Isle Co., where are located some of the best orchards in the State, he and another party examined every orchard with great care to discover if possible the cause of failure in some to produce as heavily as the others.

The results of examination showed, in every instance that, where there were failures to produce abundantly, there were no bees, or too few to be of much use; and further, that, where a good supply of bees was kept, there was in every instance a large apple crop.

Ithaca, May 1, 1911. E. L. DRESSER.

C. J. Berry, one whose fruit-orchard contains 440 acres, and Horticultural Commissioner for Tulare Co., Cal., an inland

Cucumber-blossom with a bee on it; caught in the act.

county that has made great progress in the fruit industry, gives this valuable testimony:

Bees and fruit go together. I can't raise fruit without bees. Some of the other cranks say I'm a crank; but I notice there is a pretty good following after me, hereabouts, and they keep a-comin'.

Yes, sir, 'e. I have bees all about my big orchard. *Two years in succession I have put netting over some limbs of trees; and, while they blossomed all right, nary fruit; while on the same tree, where limbs were exposed to the aid of bees, plenty of fruit.*

Some three or four years ago, in the State of Michigan, a convention of fruit-growers and beemen assembled together for the purpose of discussing their common interests; and the fruit-men acknowledged generally that the keeping of bees in the vicinity of their orchards was an important factor in the production of fruit. At the various conventions of the Michigan State Beekeepers' Association, it has been shown quite conclusively by the beekeepers who were fruit-growers, that not only greater quantity but more perfect fruit is secured by having the bees in the vicinity of orchards.

Again, Chas. A. Green, editor of the *Fruit Grower,* published at Rochester, N. Y., an article from which, for lack of space, we shall be able to quote only a couple of paragraphs:

It has now become demonstrated that many kinds of fruits, if not all kinds, are greatly benefited by the bees, and that a large portion of our fruit, such as the apple, pear, and particularly the plum, would be barren were it not for the helpful work of the honey-bee. This discovery is largely owing to Prof. Waite, of the Agricultural Department at Washington. Prof. Waite covered the blossoms of pears, apples, and plums, with netting, excluding the bees, and found that such protected blossoms of many varieties of apple and pear yielded no fruit. In some varieties there was no exception to the rule, and he was convinced that large orchards of Bartlett pears, planted distant from other varieties, would be utterly barren were it not for the work of the bees, and even then they could not be profitably grown unless every third or fourth row in the orchard was planted to Clapp's Favorite, or some other variety that was capable of fertilizing the blossoms of the Bartlett. In other words, he found that the Bartlett pear could no more fertilize its own blossoms than the Crescent strawberry. We have already learned that certain kinds of plums will not fertilize their own blossoms, such as the Wild Goose, etc.

The fruit-growers of the country are greatly indebted to Prof. Waite for the discovery he has made. The lesson is, that fruit-growers must become interested in bees, *and I do not doubt that within a few years it will be a rare thing to find a fruit-grower who does not keep honey-bees,* the prime object being to employ bees in carrying pollen from one blossom to another in the fields of small fruits as well as for the large fruits.*

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* The Oregon growers have proved that better and finer flavored apples are produced where the blossoms of one variety are fertilized with the pollen from another, and they have determined some of the best crosses.—A. C. M.

An apple tree well loaded with bloom.

Mr. F. A. Merritt, of Andrew, Ia., testifies as follows:

THE TWO SIDES OF A TREE.

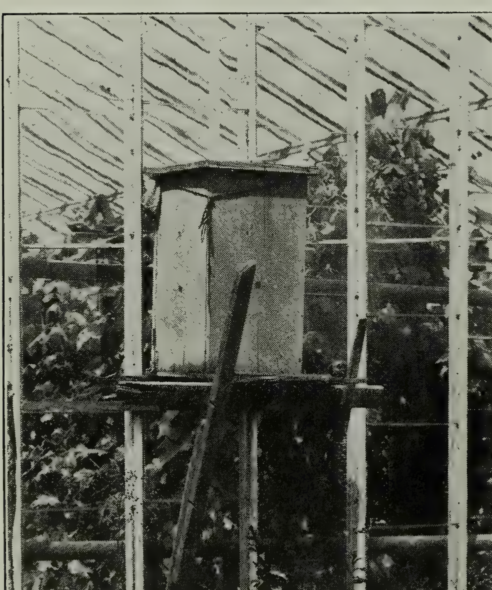
Our apple-orchard is situated in such a way that it is exposed to both the north and south winds. About four years ago, as the trees on the south row (Transcendents, that throws out a heavy growth of foliage at the same time it blooms) began to open its bloom, a heavy south wind prevailed for about five days. I noticed, during this period, that the bees could not touch the bloom on the south side of these trees, but worked merrily on the more sheltered limbs of the north side. What was the result? Those limbs on the north side were well loaded with fruit, while on the south side there was almost none to be seen. Does this prove that these trees depend on the aid of insects to fertilize the bloom? I leave it to the judgment of the reader.

Mr. G. M. Doolittle, in winding up his article for the symposium above referred to, says:

Again, I wish to note, as a matter of history, that, during the past season of 1893, very little

buckwheat honey was secured from the buckwheat regions of the State of New York—so little that we have had, for the first time in my remembrance, buckwheat honey selling in our markets for nearly if not quite the same price as No. 1 clover honey, while it usually sells for about two-thirds the price of clover honey. And what has been the result? Why, the unheard-of thing of buckwheat grain bringing 75 cts. a bushel, on account of its scarcity, while the best of white wheat is selling at only 62 cts.! As a general thing, buckwheat brings from one-half to two-thirds the price of wheat. That it now brings nearly one-fourth more than the best of wheat tells very largely, under the circumstances, on the side of the bee.

Mr. H. A. March, of Puget Sound, Wash., one of the most extensive seed-growers of the Pacific coast, testifies that he found bees very valuable, and that seed was very much more abundant when bees were allowed to work on the flowers; and he says that stone fruits seemed almost incapable of self-fertilization, as he had fully proved by trying to grow peaches under glass.



Interior of cucumber-greenhouse; hive with entrance inside.

The editor of the *Rural New-Yorker* put in his paper, unsolicted, this short pithy paragraph:

In those great greenhouses near Boston, where early cucumbers are grown, it is always necessary to have one or two hives of bees inside to fertilize the flowers. No bees, no cucumbers, unless men go around with a brush and dust the pollen from one flower to another.

Mr. J. F. Becker, of Morgansville, N. J., has eight greenhouses where he grows cucumbers, and, attached to each one of them, with an entrance on the inside as well as outside, he has two colonies of bees. He found that, without them, he could not successfully fertilize the blossoms of the vines, and, consequently, could get no cucumbers. With them he is entirely successful in growing the finest of cucumbers for the early market, where he gets fancy prices. While the bees do their part of the work, many of them are lost in the attempt to find their way back to the hive. They fly against the glass, where, of course, they worry themselves to death. This makes it necessary to supply fresh colonies* every now and then; but even this expense is made up many times over in the crop of cucumbers.

In the spring of 1892 the late Allen Pringle, of Selby, Ont., one of the leading beekeepers of Canada, testified that he was summoned to appear before a legislative committee of the House of Assembly of Ontario, to give evidence of the agency of bees in scattering pollen. The Minister of Agriculture summoned not only the leading beemen, but those engaged in growing fruit, to present the facts, experiences, and the pros and cons on both sides. Not only this, but the scientists were also summoned from Ottawa and Guelph. Mr. Pringle goes on to say, that "the horticulturists, with one single exception, admitted the valuable and indispensable offices performed by honey-bees in the fertilization of our fruit-bloom. And this was corroborated and confirmed by the entomologists. . . . Prof. James Fletcher, the Dominion Entomologist, said bees did "not visit in dull weather, and then we have but little fruit in consequence. . . . As to bees injuring fruit, there is no direct evidence."

Mr. Pringle also says:

I have kept bees for 30 years, and have grown fruit and clover alongside for the same period. I have also studied and experimented somewhat in this line as well as many others. As to some kinds of fruit—notably apples—I have observed that if, during the bloom, the weather was such that neither winged insects nor the wind (being wet and cold) could perform their function with the flowers, the fruit was lacking. When the weather at other times was favorable and the bloom abundant, I have excluded the bees from certain portions of the tree, only to find the fruit also excluded—but only from those reserved portions. . . .

The fruit-growers agreed that the "bees play a very important part in cross-fertilization, and.

* Keeping bees thrifty in greenhouses is an art in itself and it stumped me for a long time.—A. C. M.

therefore, should not be destroyed;" that "we are very generally dependent upon insects for the fertilization of our orchards. To destroy them to any extent would be very injurious to fruit-growers."

The consensus of the meeting was, that "beekeepers and fruit-growers are of great help to each other, and even indispensable, if each class is to obtain the best results in their work."

In *Gleanings in Bee Culture* for March 15, Vol. XL., Benj. W. Douglass, formerly State Nursery Inspector of Indiana, wrote:

The Greenhorn had just purchased a small orchard and had started out as a full-fledged convert to the "back-to-the-soil movement." Unlike many such greenhorns, he did not consider that he knew all there was to be known about farm and orchard work. He knew enough to know that you can not learn horticulture simply by reading books in the back parlor, and that fruit-growing requires more than a theoretical knowledge in order to make it a success.

Since I had known the Greenhorn for many years it was but natural that I should be asked to contribute my share of information toward making the new orchard a success, and I accordingly made a careful inspection of his place soon after it was bought. This was in the spring of the year, shortly after the apple trees had blossomed—and they had blossomed lavishly. To the owner's surprise, however, the stand of fruit was exceedingly poor, although there had been no frost to injure the flowers.

"It seems to me," said I, "that your only trouble here is a lack of pollination due to the absence of bees."

"But," he replied, "I have a colony of bees up under the grape-arbor at the house, so that surely can't be the reason for the trouble."

So I had to analyze the situation for him; and, briefly, this is what I said:

"Your house and the single stand of bees are nearly a quarter of a mile from the main part of this orchard. The past weeks have been very wet and cold, although not cold enough for frost. The hours of sunshine have been very brief; and during the period when the trees were in bloom the sun shone for only a few minutes at a time. Bees will not fly in such weather, or at best they fly but a short distance from their hives. Consequently your crop has failed because you did not have numerous colonies of bees scattered through your orchard. If you had done so the bees would have taken advantage of every minute of sunshine and given you a full crop where you now have a failure. If my theory in this is correct we should find that your trees near the house, in the 'family orchard,' have more fruit than these in the main orchard."

We at once investigated, and found that the trees near the house had set a very fair crop of apples. In the main orchard there were more apples near the house than there were on the further side of the orchard; for, as I have said, in that part the crop was a failure.

"Well," said the Greenhorn, "how many colonies of bees should I have on my twenty acres of orchard? and how close together should they be placed? or should they all be placed in one spot, such as the center of the tract?"

Here was a question that I could not answer, with any degree of finality. It is impossible to draw a definite conclusion regarding the exact number of bees that should be kept in order to assure good pollination. Some seasons very few bees will suffice, while it is possible to imagine a blossoming season when *any* quantity of bees would fail to provide pollination. After a long series of observations on this subject I admit that I am still almost as far from a definite conclusion as I was at the start.

In the spring of 1911 I assigned one of my assistants to a study of the insects concerned in the pollination of the apple, pear, and cherry. Without going into his results in detail I will quote from field notes made at different times during the season:

April 20.—Warm and clear. An abundance of wild bees, and flies of various species. Honeybees present in large numbers.

April 22.—Partly cloudy; cold and windy following a rain; native species of bees and flies very scarce; honeybees fairly common.

May 9.—Warm and clear. Many small native bees on cherry; in numbers they exceeded the honeybees. On the apple the honeybees were the most numerous, exceeding all other species. Syrphid flies were quite common throughout the orchard.

These notes and studies were made in an orchard where there were about seventy colonies of bees. Comparative notes made on other orchards in the vicinity on April 22 showed that very few honeybees were to be found. This proved conclusively that the presence of the apiary in the orchard was of material value in securing pollination.

Mr. Frank Benton, lately in the employ of the Department of Agriculture, Washington, D. C., in one of the Government Bulletins for 1894, page 254, commenting on the agency of bees in the fertilization of fruit-blossoms, says:

The facts they have brought forward are gradually becoming more widely known among fruit-growers and beekeepers, and additional evidence accumulates. A case illustrating very clearly the value of bees in an orchard has recently come to the notice of the writer and its authenticity is confirmed by correspondence with the parties named, who are gentlemen of long and extensive experience in fruit-growing, recognized in their locality as being authorities, particularly in regard to cherry culture. The facts are these: For several years the cherry crop of Vaca Valley, in Solano Co., Cal., has not been good, although it was formerly quite sure. The partial or complete failures have been attributed to north winds, chilling rains, and similar climatic conditions; but in the minds of Messrs. Bassford, of Cherry Glen, these causes did not sufficiently account for all the cases of failure.

These gentlemen recollected that formerly, when the cherry crops were good, wild bees were very plentiful in the valley, and hence thought perhaps the lack of fruit since most of the bees had disappeared might be due to imperfect distribution of the pollen of the blossoms. To test the matter they placed, therefore, several hives of bees in their orchard in 1890. The result was striking, for the Bassford orchard bore a good crop of cherries, while other growers in the valley who had no bees found their crops entire or partial failures. This year (1891) Messrs. Bassford had some sixty-five hives of bees in their orchard, and Mr. H. A. Bassford writes to the Entomologist: "Our crop was good this season, and we attribute it to the bees;" and he adds further: "Since we have been keeping bees our cherry crop has been much larger than formerly, while those orchards nearest us, five miles from here, where no bees are kept, have produced but light crops."

Mr. W. C. Murden, in *Gleanings* for March 15, Vol. XL., writes:

To my way of thinking, gardening and bee-keeping should always go together. From the time the vines begin to blossom until the frost kills them, the bees work on them and we have more melons, citrons, cucumbers, etc., than we ever had before we started to keep bees. Last year our vines were all loaded; in fact, some of them had almost too much fruit, and I am sure it is on account of the bees pollinating the blossoms. The bees seem to work on every thing in the garden. Even potatoes, when they are in blossom, are visited.

In *Gleanings in Bee Culture* for June 1, 1894, Prof. Cook furnishes this additional:

Prof. Bailey, the very able horticulturist of Cornell University, writes: "Bees are much more efficient agents of pollination than wind, for our fruits; *and their absence is always deleterious.*"

The Division of Vegetable Pathology, of the Department of Agriculture, has just issued a most valuable bulletin on "Pollination of Pear-flowers," by Norman B. Waite. Mr. Waite says: "Incidental mention has been made of insect-visitors. We should not proceed without laying some stress upon the importance of these visits. The common honey-bee is the most regular, important, and abundant visitor, and probably does more good than any other species." He says, further, that cool or rainy weather interferes *seriously* with insect-visits. Many varieties (22 out of 364 of those he experimented with), says Mr. Waite, *require* cross-pollination; and the pollen must be from a different variety. Bees and other insects are the agents of the transportation of pollen. In summing up, Mr. Waite says—and this from crucial decisive experiments: "Plant mixed orchards, or, at least, avoid planting solid blocks of one variety. *Be sure* that there are sufficient bees in the neighborhood to visit the blossoms properly. When feasible, endeavor to favor insect-visits by selecting sheltered situations, or by planting windbreaks."

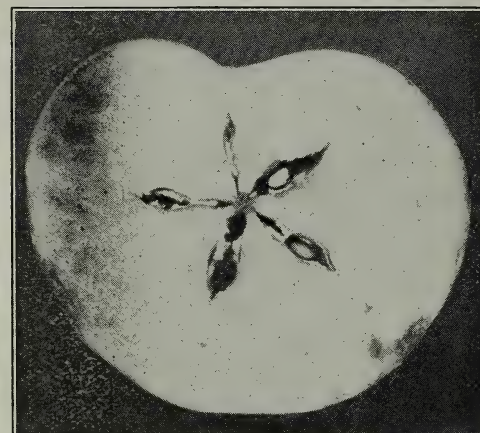
A. C. Miller, in *Gleanings* for March 15, Vol. XL., writes:

Here is a fine bit of evidence, good enough to convince him or any other fruit-grower. This photograph of an apple, cut horizontally in two, shows four seed vesicles with fertilized and perfect seed, while the fifth contains only the dead and dried ovules which were not fertilized. And the result of such non-fertilization is plainly seen in the surrounding pulp. The apple on that side is flattened. If two or three vesicles were in that condition the apple would be much more deformed; in fact, quite unmarketable.

"Now, sir, that is because the blossom was not fully pollinated. You go to work and plant hundreds and thousands of trees all in one great orchard, and the blossoms are numbered by millions. And, at the same time, old Dame Nature has not massed the insects to do the work of carrying pollen. It is up to you to help her out; and the only way in which you can do it is to put a lot of bees there."

"The bloomin' bees are in the way when I'm spraying."

"Man, you're crazy to spray when the trees are in bloom. That spray, falling on the very sensitive stigma of the flower, partly or wholly ruins it, so that, even if pollen lodges there, it can do no good. A blossom only partly injured and then pollinated would give just such a sort of apple as shown. Furthermore, you are nowadays so confoundedly thorough in your work that seldom is there a spot on any tree not reached by your spray. Just do that when the trees are in full bloom, and you will be minus a crop of fruit that season. And here is the proof. One orchardist, spraying after the petals had fallen, came to one tree which, for some reason, was away behind the others, and was still in full bloom. To save himself the trouble of another trip, he



The result of imperfect pollination. Note the shriveled condition of the upper seed and the depression in the apple on that side.

sprayed it then, and nearly every little apple dropped off. Of the few which matured, there were not a dozen perfect ones."

We must not let the fruitmen lose sight of these facts. It is our duty to help them avoid loss, misfortune, and disappointment.

And, by the way, that fruit-bloom honey sold like hot cakes, and at a fancy price too—could have sold five times as much. Get after it, boys; it's a good thing.

Providence, R. I.

Again, E. C. Green, lately of the Ohio Experiment Station, wrote:

Quite an interesting fact came under my observation this winter in tomato-forcing, along this line. We had in one house about 200 Dwarf Champions that were planted in August; and by the time winter set in they were as fine and thrifty plants as one could wish to see, and setting their fruit nicely. We felt glad to think what a nice crop of tomatoes we should have; but when January came, and they began to ripen up their fruit, the bulk of it was about the size of hickorynuts, and *without any seeds.*

The tomato, as you know, is a bisexual flowering plant, but in this case it is evident that the pollen from the same flower was what is called "self-irritant." If bees or some other cause had carried the pollen from one flower to another, or one plant to the other, there would have been a good crop. I have been doing something in cross-fertilizing tomatoes this winter, and have been surprised at the ease with which they crossed, having used the Potato-leaf, Dwarf Champion, Ponderosa, Peach, and several of the common kinds, making in all about 40 crosses. I do not think I shall fail to get seed except in a few of them. I expect that from the seed I shall get a lot of "mongrels," as one writer in GLEANINGS calls such crosses; but I prefer to call them crossbreeds, as "hybrid" has a different meaning.

Still again, Prof. V. H. Lowe, of the Geneva Experiment Station, New York, in

1899 covered a certain set of small pear-trees, as it was not practicable to use large ones, in a hood of sheeting. This hood was large enough to come down over the whole tree, something in the form of a bag, and the lower end of it was tied around the trunk of the tree. The object of this was to keep out insects, ants, bees, and any thing, in fact, that might assist in pollenizing the blossoms. On all of these trees so covered, there was a large number of buds, and all the conditions were favorable for a good crop, except that the flight of insects was entirely cut off. Now, then, for the results: Out of the whole lot of trees covered, there was just one fruit. On another set of trees of the same sort and size not covered, there were 145. In the other case, where it was not practicable to envelop the whole tree, one large limb, for instance, would be enclosed in the bag, the mouth of the bag being tied around the trunk of the limb. In one such instance there were 2483 buds on an apple-tree that were thus covered with the sheeting. Out of that number just one fruit matured. There was plenty of fruit on other portions of the tree where the limbs were not covered. In one case, where the sheeting broke open so that insects could get in, there were 13 perfect fruits from 818 buds. It was clearly shown that bees or other insects play a most important part in the pollination of average fruit-trees.

Fruit-trees in bloom in the author's orchard.

A SERIES OF EXPERIMENTS WITH DIFFERENT KINDS OF FRUIT.

The *Journal of the Board of Agriculture* (England) contains the results of some interesting observations on excluding bees and other insects from certain fruit blossoms. Here are the facts:

Gooseberries, Red and White Currants.—When insects were excluded, practically no fruit was formed. They proved, however, all self-fertile, i e., they set fruit perfectly when pollinated with pollen of the same flower or variety, but the pollen is sticky, and can not be transferred from the anthers to the stigma without mechanical means, such as is provided by visits of bees, etc.

Cherries.—Not a single fruit set when insects were excluded. Attempts to fertilize flowers with their own pollen resulted in the formation of fruit in many cases; but except in the Morello, none of the fruit matured. All the flowers pollinated from another variety set fruit.

PLUMS.—A certain number of the blossoms enclosed in bags, and left untouched, set fruit; and still more set fruit when artificially pollinated with their own pollen. All the varieties, except perhaps Victoria, seemed to set finer fruit more plentifully when pollinated from another variety.

PEARS.—The tests with these were not carried as far as in the case of the other fruit; but two varieties, Duchess d'Angouleme and Colmar d'Ete, pollinated from the same variety, set and matured fruits. A few others set fruit, but it did not mature.

APPLES.—Out of sixty-three varieties of apples on which unopened blossoms were enclosed and left untouched, the only one on which fruit set and matured was Irish Peach. Of those enclosed and pollinated with their own pollen by brush, only a few set and matured fruit. Others failed to set or mature fruit when pollinated with pollen of the same variety. In nearly all the crosses good fruits resulted. Of the 64 crosses made, 48 were successful.

STRAWBERRIES seem to be less dependent on insect agency than any other of our hardy fruits. Enclosed blossoms set fruit as well, or nearly as well, as those not enclosed.

RASPBERRIES set fruit when flowers were enclosed in muslin bags, but the results were not as good as with flowers unenclosed.

It is concluded that fruit blossoms generally are dependent on the visits of insects; and for want of these, many fruit plantations do not yield their best. Where there are no hives near, and where wild bees are not plentiful, a number of hives should be placed in fruit plantations. In the case of most varieties of apples, pears, plums, and cherries it is advantageous to have close by a different variety flowering at about the same time.

THE OPINION OF DISINTERESTED EXPERTS.

At a joint meeting of the National Pomological Society and the National Beekeepers' Association, occurring on Sept. 12, 1901, at Buffalo, a number of valuable papers were read—all of them testifying to the invaluable office of the bee in pollinating fruit-blossoms. Space will permit us to give only two references. Prof. James Fletcher, of the Ottawa Experiment Station, among other things said:

It will be found that not only are flowers absolutely necessary to bees as the source of their food—nectar and pollen—but that bees and other insects are no less necessary to most flowers, so that their perpetuation may be secured.

This fact should be recognized by the fruit-grower above all others; for were it not for insects, and particularly for the honey-bee, his crop of fruits would be far less than they are every year, and in some cases he would get no fruit at all.

Failure in the fruit crop is more often due, I think, to dull or damp weather at the time of blossoming, which prevents insects from working actively in the flowers, than to any other cause.

At this joint meeting of bee and fruit men, H. W. Collinwood, already mentioned, editor of the *Rural New-Yorker*, said:

We can easily forgive the bee his short working days when we consider the good he does. There is no question about the debt fruit-growers owe him. People talk about the wind and other insects in fertilizing our flowers; but I am confident that any man who will really take the time and pains to investigate for himself will see that the bee is nearly the whole story. I have seen the certain results of his good work in a neighbor's orchard. Those bees broke the trees down just as truly as though they had climbed on the trees by the million and pulled on them. The appearance of those trees after a few years of beekeeping would have convinced any fair-minded man that our little buzzing friends are true partners of the fruit-grower.

In addition to all this we may state that there has been a demand of late on the part of a large number of extensive fruit-growers of Wisconsin, Michigan, New York, and Pennsylvania, asking beekeepers to locate a few colonies in orchards near which there have been no bees. Indeed, the fruit-growers have offered to furnish the space and the buildings necessary to accommodate the bees and appliances, free of charge to the beekeepers. It is needless to say that the latter have availed themselves of the opportunity, for honey from fruit-blossoms is some of the very finest ever produced, and the fruit-grower profits immensely in his turn.

In one of the leading fruit-journals of the country, *Better Fruit*, for July, 1909, appears a very strong article from the Oregon College Experiment Station, showing the almost indispensable service performed by bees in pollenating fruit-trees. It is shown conclusively that many varieties are sterile to their own pollen; that wind itself is not a very important factor in carrying it from one tree to another; that the bee is practically the *sole agent* in doing this important work.

If any one desires to secure more facts relative to flower-fertilization, he may consult "Mueller's Fertilization of Flowers," an authority on the subject; also see POLLEN, and BEES AND FRUIT" in this work; also "Bees and Fruit," a separate and distinct pamphlet by the publishers of this work.

G

GALLBERRY (*Ilex opaca*), also called white holly, and holly.—A shrub of the *Aquifoliaceae*, an evergreen shrub or small tree that grows almost all over Florida. It has parchment-like leaves, oval in shape, spine-tipped at the apex, and spiny-

Common gallberry (*Ilex glabra*).

toothed. The bark is pale in color, the blossoms inconspicuous. The sterile plants are better blooming than the fertile. The blossoms are pale greenish, or white with a tint of green. The bark is a pale gray. The drupes, or seedpods, are bright red, ripening about the holidays. The northern portions of the State of Florida are better suited to its growth. It blossoms anywhere from the middle of March to early May, depending on the season, but almost always along with other honey-yielding sources, so that its honey is seldom if ever obtained separate and alone. For example, on the east coast it blooms along with the saw palmetto, and the blend is a good one. Both happen to be of good flavor, color, and body. Even where it is not in sufficient quantities to secure a surplus, it comes at a time valuable for build-

Swamp gallberry (*Ilex coriacea*).

ing up colonies for the later bloom from other sources, and tides over the dull season after orange, etc. Beemen consider it a valuable adjunct to the industry.

GLOVES FOR HANDLING BEES. Although a good many apiarists work with bare hands and bare wrists, there are a few who prefer to use gloves with long wrists, and quite a large number who use them with fingers and thumbs cut off. If the bees are hybrids, and extracting is carried on during the robbing season, it is a great convenience to use something that protects

the back of the hands and wrists, leaving the fingers bare, so that, for all practical purposes of manipulation, one can work as well with protectors as without. See EXTRACTING.

Women beekeepers and men who are at all timid, and a very small number who seem to be seriously affected by even one sting, might use gloves to great advantage —especially the last-mentioned class, where two or three stings might prove to be serious.

Bee gloves.

As to the kind of gloves, some use buckskin or dogskin* with loose flowing sleeves sewed on at the wrists, with a rubber cord gathered in the end to fit over the elbow. Then there is a kind of glove made of heavy drilling soaked in linseed oil or white-lead paint, made specially for the purpose, shown in the illustration. As sent out by the supply-dealers they are not coated, as some prefer to use them plain; but where the bees are especially cross, the fabric will need to be further reinforced with paint or linseed oil.

For further particulars regarding bee-dress, see VEILS.

GLUCOSE. This name is applied to the thick viscous liquid obtained by the concentration of a solution coming from the incomplete hydrolysis of starch. The word is misapplied by a great many, especially in the sugar-cane belt, for the reducing sugars present in the cane. From a purely chemical side, glucose means the sugar dextrose, so with these various applications of the word some little confusion exists. In the commercial world, however, the first is the accepted meaning of the word. In the United States the source of glucose is corn starch, with a little made from potato starch, but in Germany all is made from potato starch.

* If such gloves are wiped over with a solution of propolis in alcohol the bees rarely try to sting them.—A. C. M.

Its manufacture consists in the heating of the freed starch with water, and a small percentage of hydrochloric acid under pressure. The process is carefully conducted, and stopped at the proper point of hydrolysis. The liquid is neutralized with soda, and concentrated to the desired consistency, which is a liquid of about 15 to 20 per cent water. Formerly sulphuric acid was the acid used for conversion; but on account of its carrying arsenic its use was stopped. The solids of commercial glucose consist of about one-third dextrose and two-thirds dextrin. The dextrins present in commercial glucose are of a different character from those present in floral honey or honey-dew, and by this property its presence in honey can be easily detected.

By increasing the amount of acid, and also lengthening the time of heating, products are made which contain more dextrose and less dextrin. These are known commercially as "70, "80, and "anhydrous "starch sugar." They are, for the most part, solid. Their use in honey adulteration is very rare, and, if used, their detection is comparatively easy for a trained chemist.

Commercial glucose is sometimes known as corn syrup.

The ease with which commercial glucose can be detected when mixed with honey has led to its disuse except in mixtures so labeled. See ADULTERATION OF HONEY.

GOLDENROD. (*Solidago*). This is one of the most important sources of honey during the fall months in many localities in the United States. In parts of New England, various species of goldenrod grow very luxuriantly in pasture and waste lands, and are almost the sole dependence of the beekeeper for winter stores. The bees work on the flowers with great eagerness, and the activity in the apiary equals that of the midsummer honey-flow. In Massachusetts a marketable surplus, according to Burton N. Gates, is often taken in September. Allan Latham states that once in three or four years strong colonies in his apiary on Cape Cod would store upward of a hundred pounds from fall flowers. In southern Maine the

bees seldom fail to fill many frames with goldenrod honey, which, because of its golden yellow and excellent flavor, is preferred by many to white honey. In other re-

Three species of goldenrod.

gions, as in the South and West, it is of less importance; but it comes at a time of the year when it helps to keep the bees busy, and at the same time serves to make up for the loss in stores during the late summer.

The goldenrods form a genus of beautiful and stately plants which bloom from

Sweet goldenrod (*Solidago odora*).

midsummer to late fall. There are about 85 described species, confined chiefly to North America, with the exception of a few species found in South America and Europe. There are about 50 species in northeastern America. They are closely allied, and often difficult to determine. The most common and valuable to eastern beekeepers are the sweet-scented goldenrod (*Solidago odora* Ait); the Canada goldenrod (*S. Canadensis* L.); late goldenrod (*S. serotina* Ait); field goldenrod (*S. nemoralis* Ait); tall hairy goldenrod (*S. rugosa,* Mill), and in great abundance in salt marshes and along sea-beaches the seaside goldenrod (*S. sempervirens* L.). All of the species have yellow flowers save one, a slender wand-like plant (*S. bicolor*

Goldenrod (*Solidago Canadensis*).

L.), that has whitish or cream-colored flowers—a departure from the general genus habit. While this species is not common, it is frequently found by the roadside and in old pastures. There is one species that grows throughout the central northern States, which, while closely resembling the others in the form of its leaves and the structure of its flowers, differs from them

in its large flat-topped flower-cluster. This is the bushy goldenrod, formerly called *S. lanceolata* L., but recently placed in a separate genus under the name of *Euthamia graminifolia* L., Nutt. All the goldenrods secrete nectar, but differ greatly in the quantity they yield; for instance, the earliest goldenrod to bloom, the common early goldenrod (*S. juncea* Ait), is of very little value as a honey plant. The goldenrods are visited by a great number of insects besides honey-bees, and nearly 150 different kinds have been collected on the Canada goldenrod.

The bright-yellow color of the flowers renders them conspicuous both by day and evening; and as the temperature of the inflorescence at night is several degrees above the surrounding air they sometimes serve as a temporary refuge for insects. At one time there was considerable talk about making the goldenrod the national flower, for the reason that the general family is more widely scattered over the country than almost any other flower.

The honey is usually very thick, and of a rich golden color much like the blossoms. When first gathered, it has, like the honey of most other fall flowers, a rather rank weedy smell* and taste; but after it has thoroughly ripened, it is rich and pleasant. On getting the first taste of goldenrod honey, one might think he would never like any other; but, like many kinds, one soon tires of the peculiar aromatic flavor, and goes back to clover honey as the great universal staple used with bread and butter.

GRADING COMB HONEY.—The average comb-honey man either does not grade his honey at all, or else does it so poorly that it is not worthy of the name of grading. One large dealer in honey, who buys and sells hundreds of thousands of dollars' worth every year, told us that practically all the comb honey that comes into his hands has to be regraded before it is fit to send out; and, of course, he has to charge this up to the producer. Even beekeepers who are supposed to be up to date, he says, apparently pay very little attention to this all-important matter. A poorly graded honey, or one that is not graded at all, brings two to three cents less per pound *on the whole shipment.* The producer himself could easily find some one who would be willing to do such work for him, if he hasn't the time himself, for about half a cent a pound. As a rule the grading should be done by some member of the family, or some one interested in the sale of the honey. A hired man is inclined to be careless, and poor grading reacts on his employer.

Ordinary marketable comb honey can be divided in about three classes: Fancy, No. 1, and choice. Nothing but fancy should be put into the fancy, and nothing but No. 1 in No. 1. We have personally inspected thousands of pounds of comb honey that had gone to market, and it is certainly surprising how some of the intelligent producers will mix the fancy among the No. 1 and the No. 1 among the fancy, and even go so far as to put choice among the fancy. This disgusts the buyer or the commission merchant, and, of course, he charges up the cost of regrading to the producer. Or if he does not grade the honey over at all, it is sent out directly to the consumer or retail merchant, who will pay anywhere from two to three cents a pound less because the honey is of such uneven quality.

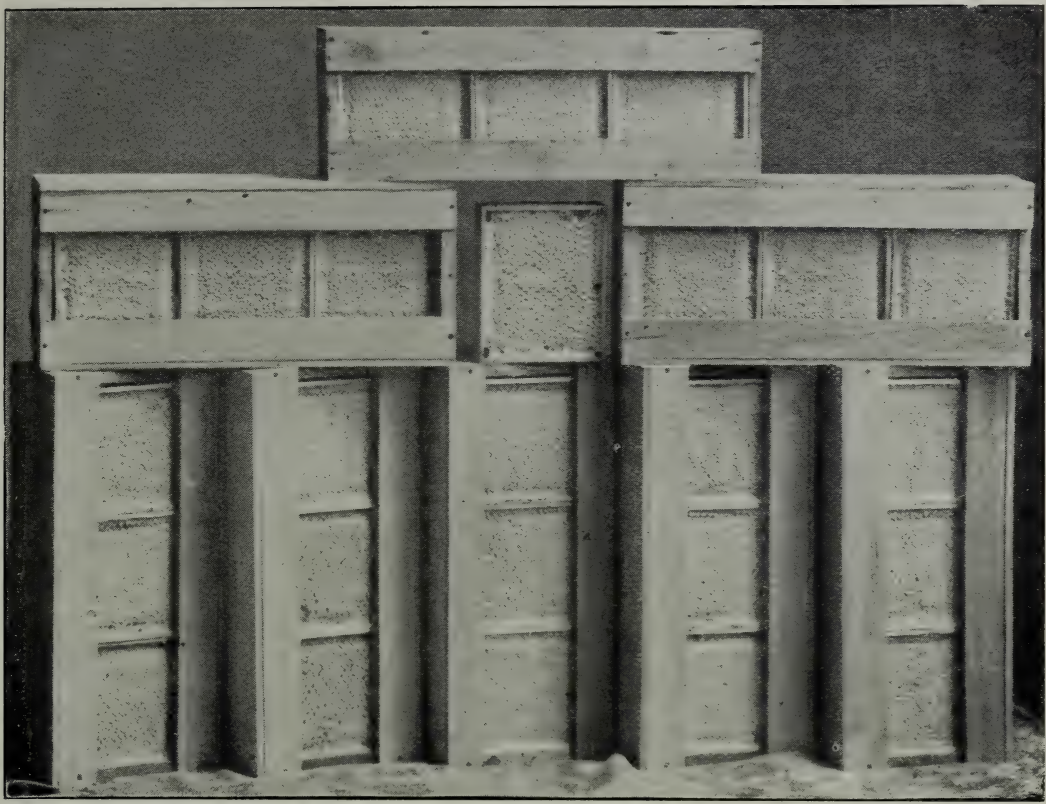
In order to get the largest price possible for comb honey, it will be necessary for us to grade it; and the more thoroughly and honestly the work is done, the higher will be the price secured. If one is careless in grading there will be inferior sections mixed in with sections of a higher grade; and if the commission man or buyer discovers this he is likely to "knock down the price" of the whole caseful to the price of the inferior sections. It is very important to have every section in a case of the same grade.

Obviously not much will be accomplished if there be a dozen different systems or rules of grading. So far they have been reduced to two—one set for the Eastern beekeepers and another for the Western. The Eastern represent the old rules and the Western the new.

EASTERN GRADING RULES.

FANCY.—All sections well filled, combs straight, firmly attached to all four sides, the combs unsoiled by travel-stain or otherwise; all the cells sealed except an occasional one, the outside surface of the wood well scraped of propolis.

* So pronounced is the odor and so much "like something dead" that many a beekeeper has been greatly disturbed believing his bees had foul brood. The combs built when goldenrod is yielding are of a most beautiful golden yellow—A. C. M.



Honey sent by the Ontario Beekeepers' Association to King Edward. Note.—This would grade as Extra Fancy by the Eastern grading rules.

A No. 1.—All sections well filled except the row of cells next to the wood; combs straight; one-eighth part of the comb surface soiled, or the entire surface slightly soiled; the outside surface of the wood well scraped of propolis.

No. 1.—All sections well filled except the row of cells next to the wood; combs comparatively even; one-eighth part of comb surface soiled, or the entire surface slightly soiled.

No. 2.—Three-fourths of the total surface must be filled and sealed.

No. 3.—Must weigh at least half as much as a full-weight section.

In addition to this the honey must be classified according to color, using the terms white, amber, and dark; that is, there will be "Fancy White," "No. 1 Dark," etc.

These are based on a set of rules originally adopted by the National Beekeepers' Association in convention at Washington, D. C., in December, 1892. It will be seen that the question of color and source is taken care of very nicely in the last paragraph, so that we can have a No. 1 or fancy amber or a fancy buckwheat, the same as a fancy clover stock.

THE COLORADO COMB-HONEY GRADING RULES.

The Colorado Honey-producers' Association, one of the most influential organizations in the United States, adopted a set of grading rules that in many respects are a decided advance over the Eastern rules. Not only the rules but the general instructions on grading are worthy of careful reading by Eastern beekeepers as well as those of the West. Here are the rules, together with the instructions for grading:

NEW HONEY-GRADING RULES ADOPTED BY THE COLORADO STATE BEEKEEPERS' ASSOCIATION, DECEMBER 13, 1911.

Fancy White.—Sections to be well filled, comb firmly attached on all sides and evenly capped, except the outside row next to the wood. Honey, combs, and cappings white, and not projecting beyond wood; wood to be well cleaned; no section in this grade to weigh less than 13½ ounces.

No. 1.—Sections to be well filled, combs firmly attached on all sides and evenly capped, except the outside row next to the wood; honey white or very light amber; comb and cappings from white to slightly off color; comb not projecting beyond the wood; wood to be well cleaned; no section in this grade to weigh less than 13½ ounces.

Choice.—Sections to be well filled, combs firmly attached, not projecting beyond the wood, and entirely capped, except the outside row next to the wood; honey, comb, and cappings from white to amber, but not dark. Wood to be well cleaned; no section in this grade to weigh less than twelve ounces.

No. 2.—This grade is composed of sections that are entirely capped, except row next to the wood, weighing from ten to twelve ounces; also of such sections that weigh 12 ounces or more and have not more than 50 uncapped cells all together, which must be filled; combs and cappings from white to amber in color but not dark; wood to be well cleaned.

EXTRACTED HONEY.—Must be thoroughly ripened, weigh 12 pounds per gallon. It must be well strained, and packed in new cans. It is classed as white, light amber, and amber.

STRAINED HONEY.—This is honey obtained from combs by all other means except the centrifugal extractors, and is classed as white, light amber, amber, and dark; it must be thoroughly ripened, and well strained. It may be put up in cans that previously have contained honey.

GRADING INSTRUCTIONS.—The aim of establishing grading rules is to secure uniformity in the methods of packing and grading, and thereby make it possible to put on the market a product of such excellence that careful buyers will pay top prices for it.

A few brief directions are deemed necessary to the parties doing the actual work of preparing, grading, and packing.

In removing filled supers the smoker must be kept well filled so no ashes will spot the cappings. Robber bees must be kept from them; and when piling supers up in the honey-house, one or several sheets of newspaper should be used between supers, to catch any possible drip and keep out dust and ants.

The shipping case adopted as the standard by the Colorado State Beekeepers' Association is the double-tier case with glass front, holding twenty-four sections, 4¼x4¼x1⅞ inches each. Use slim cement-coated flat-head nails one inch long for nailing cases, put the best-looking side of grooved front strips to the outside, and select the best and smoothest finished boards for covers. If bottom or cover boards should project, they must be planed off. This is necessary for proper loading. A sheet of plain paper goes into the bottom of the case, forming a tray; on top of this belongs a sheet of corrugated cardboard, corrugations up. On top of the lower tier of sections goes another paper tray and cardboard. Generally a sheet of corrugated cardboard is also furnished to lay on the top tier of sections. If this is not the case, and plain paper is used, it must not be permitted to stick out of the case.

The mark of the grade of honey must be put into both handholes of each case, as follows:

Fancy white must be marked XX in handholes.
Number one must be marked X in handholes.
Choice must be marked I in handholes.
Number two must be marked II in handholes.

Sections must be well scraped. This means that all propolis (bee-glue) and beeswax must be removed from the edges and outside of all sections of honey. Some use a short and very sharp butcher-knife with broken point; others prefer a smaller knife with a *square* edge, kept square by the frequent use of a file. Sections that are badly mildewed must be put into the cull honey.

The cleaning and grading of honey must be done in a well-lighted place, but not in the direct rays of the sunlight. A well-ventilated and screened room with one or several large north windows is the best ideal. No grading should be done by artificial light, because neither artificial light nor strong sunlight will enable a person to grade comb honey properly, owing to its transparency. A large bench or table is needed to give plenty of room for the work and the placing of shipping cases to pack the various grades in. Except for the fancy white it is necessary to have several cases for each grade on the bench so that honey of the same shade and finish will be cased together. Even in the No. 2 grade the packing of various shades of color in one case is bad work.

To avoid errors in casing, each grade should always have the same space on the bench, and cases should be marked with grade before covers are nailed on.

If possible one person only, with a good eye for color, should be entrusted with the work of grading the crop. The other work may be done by any number of persons. This plan secures uniformity of grading, and places the responsibility for this most important work on one person. The grader should be provided with a copy of the grading rules and specimen sections, two or three of each grade, the poorest that are to go into each grade, have these specimens properly marked, and kept before the grader at all times, with instructions not to put any thing into a grade poorer than the specimens; and if in doubt about a section, to put it into the next lower grade.

A sensitive spring scales, with large dial, plainly indicating half-ounce, is needed for weighing doubtful sections. A scale especially adapted for the work can be bought for $1.50. After using the scales for a short time most graders will find that but a small part of the crop needs to be weighed, as they soon get very proficient in judging weights.

The front sections of honey in a case must be alike in color and finish, and a true representation of the contents.

COMB HONEY NOT PERMITTED IN SHIPPING GRADES.

Honey packed in second-hand cases.
Honey in badly stained sections.
Honey showing signs of granulation.
Leaking, injured, or patched-up sections.
Sections containing honeydew.
Sections with more than 50 uncapped cells, or a less number of empty cells.
Sections weighing less than the required weight.

Such honey may be sold around home or rendered.

Don't put off. Case comb honey as soon as taken from the hives, and market while weather is warm. The early market is usually the best.

Don't haul without springs, and don't allow cases to get soiled or dusty.

Don't ship comb honey in less than car lots unless packed in carrier crates holding 8 cases each, with straw in bottom.

Don't ship by express, except very short distances. Freight is cheaper and just as safe.

Notice.—As practically all beekeepers are now using separators between each row of sections, no provisions are made in the grading rules for half and non-separatored honey.

TO EXTRACTED-HONEY PRODUCERS.—Do not get honey contaminated by excessive use of smoke.

Be sure honey is thoroughly ripened and well strained before putting into cans.

Put sixty pounds net in each five-gallon can.

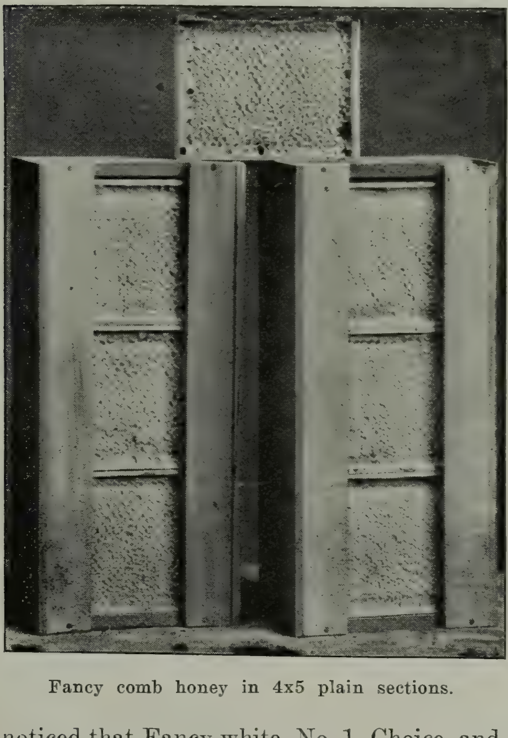
Adopt the plan of marketing each extracting with a different number or letter, as there is usually a variation of color and flavor in the different extractings. If a good-sized sample is kept of each lot with the mark and number of cans in lot on it, it is easy to satisfy an intending purchaser as to quality and color.

Cases should be nailed with 7-penny cement-coated box nails; and for long-distance local shipment the ends should be strapped with band iron or wire.

The grading of any article, honey not excluded, is a simple matter if the person doing the grading will follow the golden rule and put himself in the place of the buyer.

These rules provide for a Fancy, No. 1, Choice, and No. 2 grades. These four grades are sufficient. Any thing below No. 2 should be sold around home, because it will not bear shipping any distance. In this connection it is proper to observe that the grades of Fancy white and No. 1 provide for attaching combs to *all four* sides of the section. This is very important from the standpoint of shipping. The grade "choice" provides only that the comb should be "firmly attached." While combs fastened to tops and sides of sections will ship fairly well, they occasionally break out, causing a dripping mess in the case. It is, therefore, possible that "choice" may bring less money, because of this danger, than it should.

It will also be observed that the Fancy white and the No. 1 provide against bulged combs; and in this connection it should be noticed that Fancy white, No. 1, Choice, and No. 2, provide for a limit on each individual section as to weight; and No. 1 places that limit at 13½ ounces, which makes a limit on a case holding 24 sections of 20¼ lbs. The individual limit on the weight of the sections effectually bars the use of unseparatored combs. Under the old Colorado rules the limit was placed on the *case* and not on the *sections*. This made it possible for the man who could not be persuaded to use separators to place a 10-ounce section in with those weighing 15 ounces; and so long as the *case* of 24 sections came up to the limit provided, of 22 to 24 lbs., all of those sections would bring the highest price. Under the present grading rules a 10-ounce section is barred from *all* the grades; and this is emphatically right. Nothing causes more trouble between the producer and buyer than lean and fat combs in the same case. One that is overfull is unsightly; and one that is very much under weight will not sell. The great majority of sections are sold individually; and while a dealer *can* sell a 10-ounce section for 10 ounces, he much prefers to handle the more uniform product which has a uniform appearance.

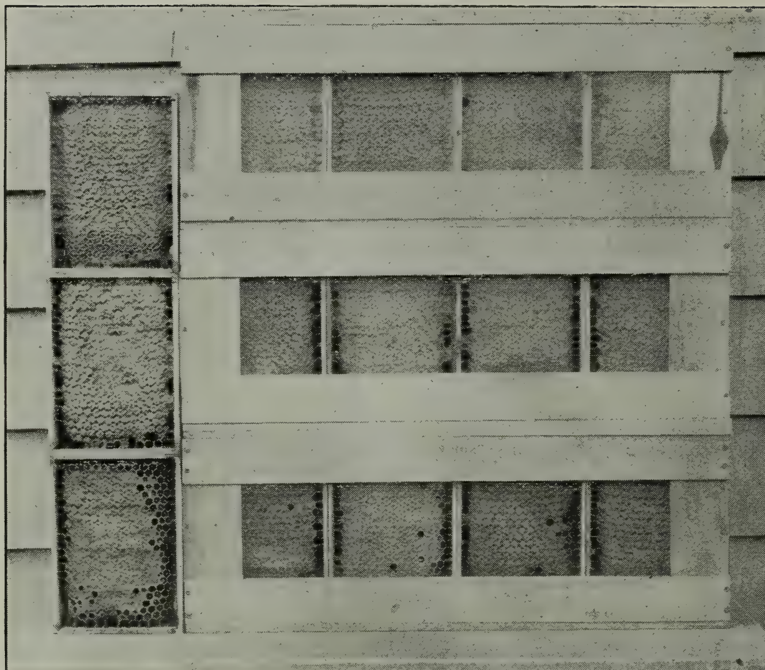


Fancy comb honey in 4x5 plain sections.

The provision in the suggestions as to the scraping of all sections will have a strong tendency to shut off from the market goods put out by the slipshod and uninformed beekeepers—a class who make a great deal of trouble, not only for themselves but for their more up-to-date brethren.

While a recommendation is made for a 24-lb. double-tier shipping-case, the rules do not bar the use of single-tier cases of the same capacity.

These rules are so much of an improvement over the Eastern rules, which are clearly out of date, that the average producer of honey who reads these pages will do well to follow the Colorado gradings, because they are specific in their requirements. When a producer offers his crop of honey graded according to these rules, the buyer knows exactly what he is to get—namely, sections of a required filling and weight, and of color. If they fall down in any particular it removes all possibility of any haggling as to the price. If the goods do not come up to the standard provided by the grading, then the buyer has a right to demand a corresponding reduction, or hold the goods subject to the producer's order. This will tend to make the producer more careful in the future; and in the end the business of comb-honey production and its sale will be much more pleasant and profitable.



Grading rules illustrated.

GRADING BY PICTURES.

Some effort has been made to grade honey by means of pictures; but nothing definite has been accomplished, as it is difficult to make photos flexible enough to take in the various comb surfaces and cappings of honey that can be included in one grade. It is possibly true plates may be used *in connection* with the rules, to enable one to determine what section will grade A No. 1, Fancy, or No. 2; for it must be understood that different persons would have a different idea as to whether one section should be graded as No. 1 or Fancy, and a set of pictures showing the idea of an expert on grading might be helpful to a novice. We have given here a few plates that may give an idea of what is meant. But it should be understood that in the pictures the unsealed cells show black—much more in contrast than in the actual combs themselves; or, to put it another way, in any thing but an extra fancy, where no empty cells show, the pictorial representations do not show up as well as the real article.

The honey sent to the late King Edward would be what is called "extra fancy white," according to the Eastern grading, for it is white honey put up in plain sections, and, as the illustration shows, it is evenly and nicely filled. When cells next to the wood are all sealed, or nearly so, it should be designated as "extra fancy;" but as such are the exception rather than the rule there will be very little "extra fancy" on the market, although such honey is generally shown at exhibitions when competing for a prize.

In the half-tone engraving above shown the honey in the top case, with its sample section opposite, would, by the Eastern grading rules grade Fancy; that in the middle case No. 1A or No. 1, according to the amount of soiled surface, and that in the bottom case would be about No. 2.

TRAVEL-STAINED AND OTHER SOILED SECTIONS.

There are really four classes of discolored sections, each due to a distinct and separate cause. First there is what is called the real travel-stained section. As its name indicates, the cappings are soiled because the bees have gone over the surfaces of the cappings with their dirty feet.

Then there is another lot that are stained because the boxes are capped over in the vicinity of old comb, dirt, or propolis. If

the faces of such sections are examined carefully it will be found that the stain or discoloration goes *clear through.* These discolorations are due to the fact that the bees take up pieces of old black wax, propolis, or any thing that will answer as a substitute or filler for pure wax. We have seen the cappings of some sections of this sort filled with bits of old rope, lint from newpapers, small hard chunks of propolis, fine slivers of wood—any thing and every thing that is right handy. Sections of this class often look like those of the first class, hence the frequent confusion.

In the third class are those with soiled cappings, due to the pollen dust or possibly a thin layer of propolis stain.

The fourth and last class takes in all those that are called "greasy" or "water-soaked," having cappings that lie on the honey. The covering to each cell is more or less transparent, or water-soaked—the transparent part being half-moon shaped, or in the form of a ring encircling a white nucleus center that is not greasy or transparent. See BLEACHING COMB HONEY.

GRANULATED HONEY. All liquid honey, and some comb honey, is liable to cloud and partially solidify at the approach of cold weather; that is, it assumes a granular mealy condition, something like moist Indian meal, and again like moist fine white granulated sugar. The granules of candied honey are about the size of grains of ordinary table salt, but may be much finer with some grades of honey. *Comb* honey granulates to a very limited extent, and only after a much longer period, than extracted. While cold weather is much more conducive to granulation, yet in some localities, and with some honeys especially, it takes on the semi-solid form even in *warm* weather. Some honeys will candy in a month after being taken from the comb, and others will remain liquid for two years. The honey most likely to granulate is extracted alfalfa, which does so in from three to five months. Mountain sage from California and tupelo from Florida remain liquid for a year or longer. Ordinary comb honey in sections, if well ripened in the hives before it is taken off, will usually remain liquid for a year. After that time, especially if it has been subjected to cold during the previous winter, there are likely to be a few scattering granules in each cell. These gradually increase in number until the comb, honey, and wax become almost one solid mass. In such condition it is fit neither for the market, the table, nor for feeding back, and should be treated by the plan we will describe presently.

IS GRANULATION A TEST OF PURITY?

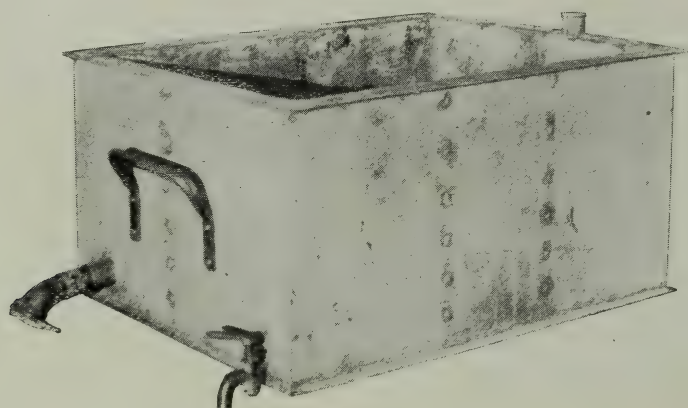
In the eyes of the general public, granulated honey is not pure, many thinking it has been "sugared," either with brown or white sugar. But the very fact that it granulates solid is one of the best proofs of its purity. If honey granulates only partially, in streaks, it *may be* evidence of the fact that it has been adulterated with glucose. But even pure honey will assume this condition, while honey that is nearly two-thirds or three-quarters glucose granulates very little. Here, again, it must not be taken as positive evidence that, because honey refuses to granulate, or does so only slightly, therefore it is adulterated. The purity of any honey can usually be determined through the taste by an expert beekeeper who has tested various grades of honey, and knows their general flavor. But here, again, even taste must not be considered an infallible test. Doubts can be removed only by referring a sample or samples to an expert chemist. See ADULTERATION OF HONEY.

HEATING HONEY TO PREVENT GRANULATION.

There is no plan that will act as an absolute preventive; but by a method which we will describe, granulation can be deferred for one and possibly two years. Even after treatment, if the honey is subjected to a freezing and thawing temperature for a series of days it will be almost sure to start candying again. Continuous cold weather with the mercury slightly above zero is not as favorable as alternate cold and warm weather.

After the first few days the honey will appear slightly cloudy. This murky appearance grows more pronounced, and granulation proceeds more rapidly, until the point of solidification is reached. But there is no excuse for having honey at any time, either comb or extracted, kept in a zero or freezing temperature; for all practical purposes we can prevent honey candying for a year on the average.

There are two methods commonly in vogue to heat honey. One is, to put it in a double boiler or vat, and gradually raise the temperature to 150 or 160 degrees Fahr., holding it at that point till all the honey is melted. It should then be put into bottles or tin cans, and sealed while hot. While this plan is very good, a much better one, in our opinion, is to liquefy the candied honey entirely, and keep it at a temperature of 130 degrees Fahr. for three days. Do not let it go above 135 degrees. The process of melting will be very slow, and a continuous slow heat so acts on the honey that it will remain liquid much longer than when the heat is applied more rapidly and raised to a higher point. It is then sealed hot, as in the other case.



Double boiler for liquefying honey.

For full particulars on bottling honey to keep it in a liquid condition, see Bottling Honey.

To liquefy honey in the candied state, or to heat it to prevent its getting into that condition, the honey should be placed in a double boiler—that is to say, a tank with double walls, having the space between the walls filled with water. This may be placed on the stove and filled with honey. The double boiler used by the Rauchfuss brothers, of Denver, Col., is shown in the engraving, and its manner of construction will be apparent.

Where one doesn't have such a boiler, and can not afford one, he can make a very good substitute by taking a common wash-boiler. Into this put some blocks about an inch square. On these blocks place three or four tin pails, or as many as will go into the boiler. Should he have something larger than a wash-boiler it would be all the better. The honey is then filled into the tin pails. If granulated solid it may be handled with a spade. Water is poured into the wash-boiler until it comes within two inches of the top of the pails. The whole is then placed on the stove, and subjected to a slow heat. When the water reaches a temperature of 160, or nearly that, let the fire be checked; the honey should not become any hotter, because it may otherwise injure the flavor as well as the color. Honey should never be brought to a boiling temperature except to kill the germs of foul brood, when all such honey should be fed back provided it has boiled at least two hours.

Dayton's outfit for liquefying candied honey.

Mr. C. W. Dayton, of Chatsworth, Cal., has another and very simple outfit to liquefy honey. As it can be made out of materials found in any beekeeper's yard, at very small cost, many will, perhaps, pre-

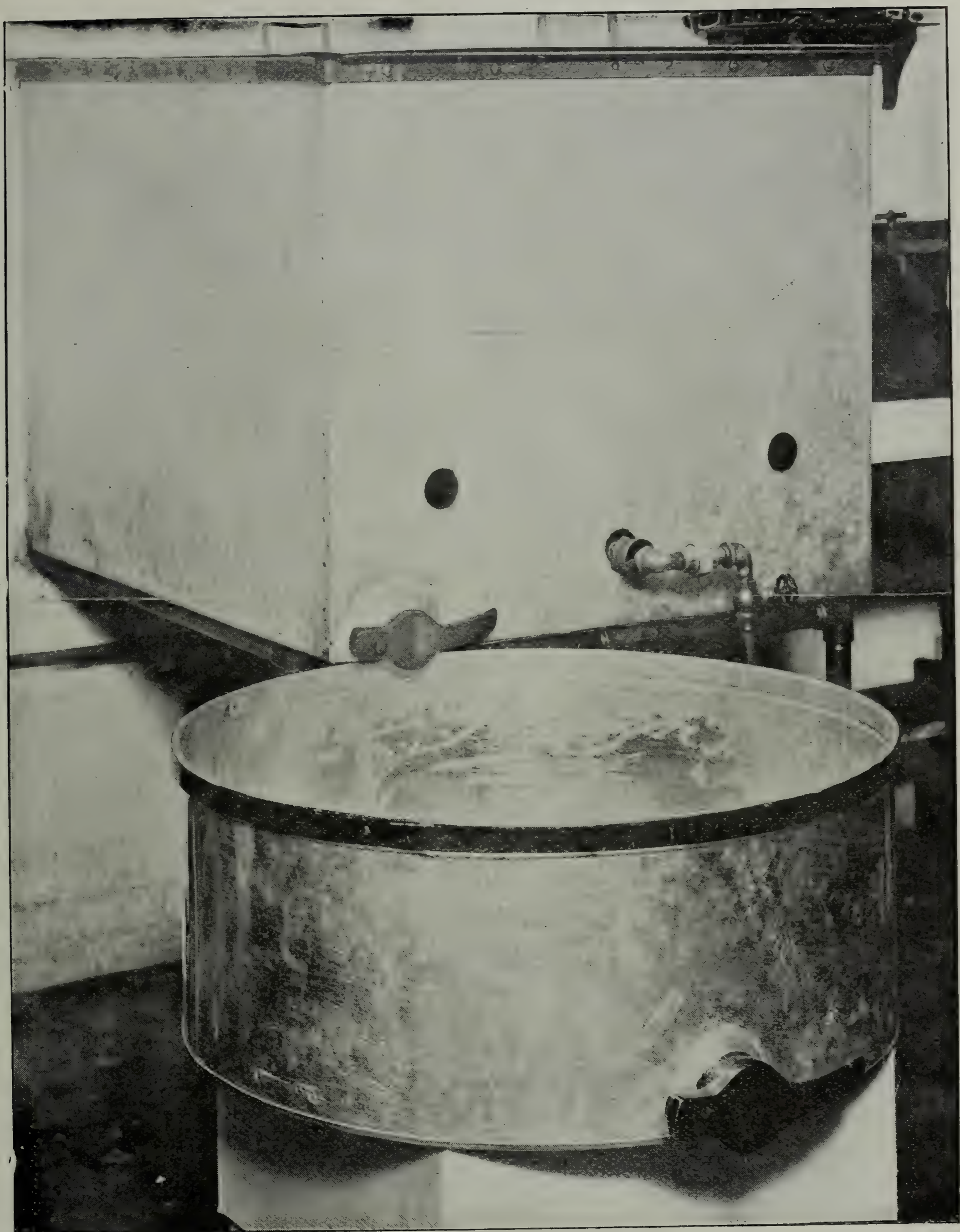


Fig. 1.—Pouder's hot-air oven for liquefying honey in sixty-pound cans. The cans are held upside down, as shown in Fig. 2; and the honey, as fast as it becomes liquid, runs down to the bottom of the oven and from thence out the gate, away from the heat.

fer it to the Rauchfuss double boiler just described.

As will be seen from cut, previous page, Mr. Dayton makes use of second-hand kerosene-cans, which may be purchased for five cents apiece. He cuts off the top at a convenient height, then washes out the cans thoroughly. For the purpose of liquefying he uses eight on top of an ordinary cook-stove. To keep the honey from burning he gets some band iron, ¾x3-16, at some hardware store, and makes a series of hoops on which the cans are to stand while heating. Eight of

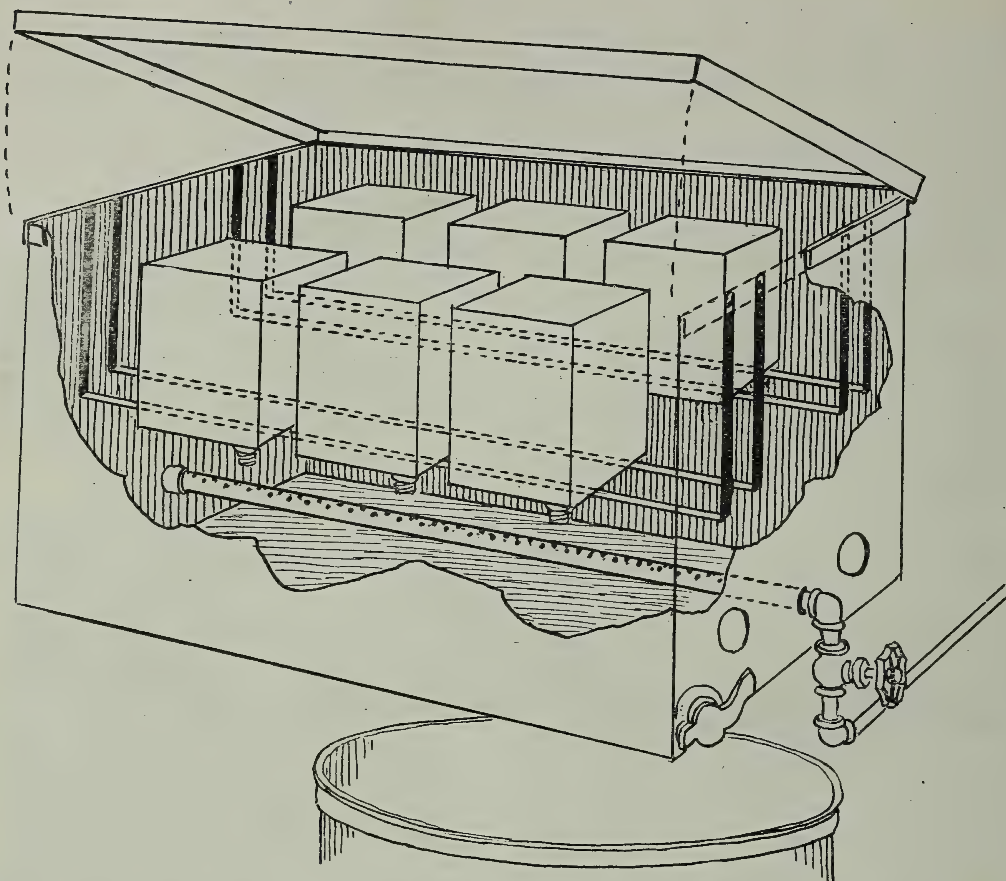


Fig. 2.—Pouder method of liquefying granulated honey, showing the position of cans and gas-burner in the oven.

them are placed together as shown; when, to conserve the heat further, a tin cover large enough to slip down over the whole is provided.

With the help of this outfit Mr. Dayton says he can melt up 200 lbs. of honey in a very short time. We should like to suggest that these cans would be more convenient to handle were he to take heavy wire, make some bails and hook them into holes punched on two opposite sides. He would then have a very serviceable pail at a small cost; and, when the honey is melted, he could lift it off the stove and pour it into some other receptacle from the corner of the cans. This corner makes the finest kind of pitcher mouth, avoiding any spilling of the honey.

THE POUDER ARRANGEMENT.

Undoubtedly the best arrangement for liquefying granulated honey in square cans is that used by Walter S. Pouder. Here is what he says of it:

LIQUEFYING GRANULATED HONEY.

For years I have depended upon the hot-water tank for melting five-gallon cans of granulated honey, but have found many inconveniences connected with the method, and have been obliged to adopt a safer and speedier method. To take care of the expansion I have used syphons, coal-oil pumps, funnels soldered to perforated screw caps, and other methods, but have always found a lack of tidiness; and in some instances we have ruined very superior honey by overheating. If we overlooked a nail hole near the bottom of a can we would find a can of sweetened water instead of honey; and in lifting heated cans from the water I have had the handles pull off; and the can, in falling back, would cause the hot water to slop over and scald my toes till I have seriously wished that I did not have to dabble in honey at all.

I have longed for a method in which the liquid honey would flow away from the heat as fast as it became fluid, and at last I have such a device in use, and I believe many readers of GLEANINGS will be interested. It is simply a gas oven, made of heavy galvanized sheet iron, and of a capacity for six cans, three on each side of the gas-burner, cans to be suspended on brackets in an inverted position with caps removed. When in use the honey-gate at the bottom of the oven is left open; and as fast as the honey becomes liquid it flows to the outside tank. Considerable experimenting was required in order to maintain proper temperatures, and we have learned to regulate the tem-

Fig. 3.—Samples of paper milk-bottles suggested by Walter S. Pouder, for retailing liquid honey. The stopper is crowded tightly into the small end with the wooden plunger. When clear in, it is impossible to remove the cap without the use of a knife or screwdriver. The cap is put on the small end to reduce the liability of leakage.

perature by using a thermometer before we place any honey in the oven. Naturally the highest temperature is nearest the top of the oven, and we are able to keep within 180 and 190, and the temperature declines toward the bottom of the oven, hot air being circulated throughout. Some heat is slightly radiated against the lower part of the cans, and I find this in my favor, as it tends to prevent openings of cans being clogged with granulated honey.

The two round openings in the front are for ventilation, and to secure perfect combustion. There is a three-inch space between the burner and the bottom of the oven; cans are suspended with a 13-inch space between the bottom of the cans and the bottom of the oven, and a two-inch space over the tops of the cans; and there is also a twelve-inch space between the two rows of cans. We also find the device very convenient in melting jars of granulated honey without so much as injuring the label by simply inverting the open jars on a heavy wire screen.

Such an oven could be constructed for any capacity—for two, four, or six cans at one time, and could be used over a gasoline-stove where gas is not obtainable. A thermostat could be added, thus making it an automatic arrangement; but in my business I have not found it necessary. The honey, as it flows into the outside tank, is just right to be strained into our bottling-tank, and there is no deterioration, because it could not be overheated.

Visiting beekeepers pronounce the entire arrangement a model of perfection, and I submit the above description by request.

PAPER MILK-BOTTLES FOR EXTRACTED HONEY.

Since Mr. J. E. Crane introduced the paper milk-bottle for extracted honey I have felt much interest in the affair; and a manufacturer of this ware has supplied me with a liberal lot of samples which I have been testing. In my opinion this bottle will fill a long-felt want where honey is offered at retail, and at such places as market-stands, for a great many people would like to take home with them a pound or so of honey if a neat container could be furnished without cost. I have used paper oyster-pails for this same purpose; but removing the honey from an oyster-pail is always untidy at the best, while the waxed bottle is very neat and attractive, and easily drained into a dish.

I believe there are several patterns of these bottles now being offered, of different sizes and shapes. The ones that I have been using have a neat paper stopper, Fig. 3, which could be sealed with hot paraffine if so desired. I also find the package very desirable for granulated honey in a damp climate such as we have here, and jars could be filled while honey is semi-granulated, and then allowed to granulate completely; and in preparing for the table the waxed paper could be easily removed. If made in quantities, suitable reading-matter could be arranged, leaving a blank space in which the producer could stamp his name.

While I have not tested these jars as to shipping qualities, I feel sure that they would stand all requirements. I will explain that I have none of these jars for sale, but I believe they should be classed along with our honey-packages; and when understood they will be in demand and they will fill a long-felt want.

Indianapolis.

Under Bottling Honey we give another method for preventing granulation by sunlight. The reader is referred to the subhead covering that point.

MELTING UP HONEY IN A CAPPING-MELTER.

Under the head of Extracting and Comb Honey we describe the use of cap-

ping-melters with a set of illustrations. This outfit is also well adapted for melting up candied honey, especially candied comb honey. Ordinary granulated extracted will run through it very readily without any danger at all of impairing the flavor, and, what is more, it will be strained in the process. In the case of candied comb honey, the wax and honey will be very nicely separated by the device shown under EXTRACTING, subhead "Capping-melters;" in fact, when comb honey candies, we do not know what else to do with it than to run it through a capping-melter, selling the honey for what it will bring as extracted and the wax at its market price. If the capping-machine is properly handled the quality of neither the wax nor the honey will be affected, and the combined price of the two will probably exceed what one could obtain if he attempted to sell, if he could at all without melting up.

Under BOTTLING HONEY will be found several other devices for melting up honey that might likewise be used to advantage.

CAUSE OF GRANULATION.

As already stated, the primal cause is alternation of cold and warm weather. During any very cold temperature, prolonged for days, honey probably would not candy at all, but chill into a hard waxy mass, readily softening again in a warm atmosphere. As some honeys differ chemically, it may be assumed that some other cause than warm and cold changes operates to bring about the solid condition. Just what that is, we do not know; only we do know that stirring or violent agitation hastens granulation; and we also know that, if some granulated honey is mixed with ordinary liquid extracted, the latter will candy much more rapidly; for when honey *once starts* to granulate, the process goes on very rapidly, although it may take from ten days to six months for the honey to pass entirely from the liquid condition into the solid.

Under BOTTLING we spoke of there being two ways to prevent honey from granulating. The first method employs artificial heat. The second one uses the actinic rays of the sun, that probably have some effect in preventing granulation, aside from the heat itself from the direct rays of the sun. For full particulars regarding this, see BOTTLING HONEY.

FREAKS OF HONEY-GRANULATING.

This problem of honey-granulating is very interesting. It sometimes transpires that of two lots taken from the same barrel or can, and placed in two self-sealing packages, the honey in one will soon candy while in the other it will remain liquid, notwithstanding that both packages have been subjected to the same temperature and general conditions. If this happened in the case of sealed packages only we might suppose that the sealing of one package was less perfect than the other; but that the candying does not depend on the sealing altogether is shown by the fact that the two lots of honey may not be sealed at all, and yet one of them turns to a solid while the other remains liquid. It should be stated that these instances are by no means frequent; indeed, they are rare; yet they occur just often enough to excite curiosity.

Another interesting fact is that, while honey may candy solid within six months from the time it is taken from the comb, when kept in the same cans under the same conditions for a period of two or three years a gradual change takes place, or at least has been known to do so. We have seen alfalfa honey after it had been in glass jars seven years, and were told that it had candied solid within a few months after being taken from the extracting-cans. At the time we saw it (seven years after), it was going back to the liquid condition. Some cans were almost entirely liquid, and others had streaks of granulation reaching out like the branches of an evergreen-tree all through the package. There is every evidence to show that so far it has undergone a slight chemical change. This change is doubtless due to the continued effect of light upon the granules. See "Sunlight to Prevent Granulation," under BOTTLING.

THE SCIENCE OF GRANULATION.

While we do not know very much as yet about the theory of honey granulating, yet we do know that, while the nectar of flowers may be, chemically, cane sugar, yet after it has been stored in the hive by the bees, and partially digested or worked

Aikin's paper-bag honey-package for granulated honey.

over as explained under HONEY elsewhere, it is known to science as invert sugar. Ordinary honey is a combination of dextrose, levulose, and water, in approximately equal proportions. "Honey candies upon standing," says Dr. Headden, of the Colorado Experiment Station at Fort Collins, "because of the ability of its dextrose to assume a crystalline form much more readily than the levulose." At the Colorado State beekeepers' convention, he showed samples of free dextrose and levulose. The former looked like very nice light-colored brown sugar; the latter appeared like a cheap grade of dark-colored molasses. The doctor went on to explain that, if granulated honey were subjected to a sufficient pressure, the greater portion of the levulose could be obtained, leaving the solid mass largely dextrose. The levulose of honey candies slightly, but is very different in appearance from its dextrose constituent.

HOW TO GET GRANULATED HONEY OUT OF BROOD-COMBS AND YET SAVE BOTH THE COMB AND THE HONEY.

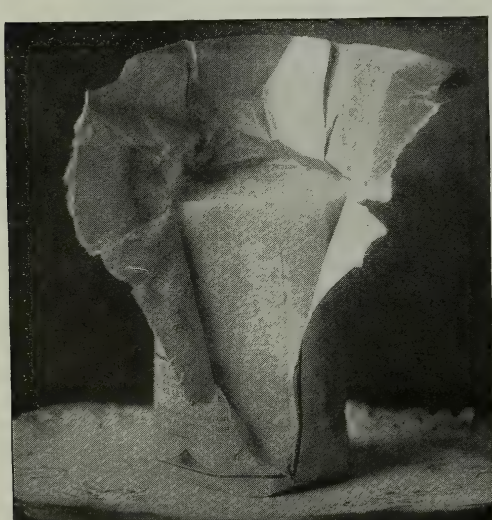
Where honey granulates at all in brood-combs, it will usually be only partially. After uncapping, M. M. Baldridge, of St.

Charles, Ill., recommends placing all such combs in the extractor, and throwing out any portion of the honey remaining liquid. He next lays the combs in the bottom of a clean wash-boiler, and, from an elevated dipper, pours water slowly into the cells. He then turns the comb over and treats the other side the same way. As fast as the combs are splashed with water he places them in a hive or super. After they have all been doused he takes them out and sets them over strong colonies. He says the bees, by aid of the water, liquefy the whole mass, clean the combs, and save both the combs and honey.

Candied comb honey in sections can scarcely be treated in this way, as it would be impracticable to uncap the cells. These should be treated in a capping-melter, as directed a couple of pages back.

HOW TO MARKET GRANULATED HONEY.

Some years ago attempts were made to put up granulated honey in small packages for retail purposes; but it was not until the year 1901 that any real progress was



Aikin's paper-bag package dissected for the table.

made. At that time R. C. Aikin, of Loveland, Colo., began to put up his honey in cheap lard-pails. He allowed it to candy, and then sold it direct to consumers. The packages being cheap he could afford to put the honey on the market at a price that would compete with ordinary sugar. A little later on he conceived the idea of using stout paraffine-paper bags instead of pails, and made a complete success of it.

Alfalfa honey in Colorado is well known to granulate very rapidly. As soon as the graining begins to show he draws the honey off into the bags, and allows them to stand in a cool place, when it soon candies. Illustrations show the style of the bag after it has been filled and the top edges folded down. The honey readily candies into solid bricks, and will stand all kinds of rough treatment. The only expense is for bags, which can be bought of supply-dealers, in 2-lb. size, for $7.00 per 1000, and other sizes in proportion. It was thought for a time that Eastern clover and basswood honeys would not candy solid enough when put up in this shape; but experience shows that they can be handled in that package as well as alfalfa, providing they are already graining when the bags are being filled, or if a little old candied honey is mixed in to expedite the process. *This is very important in the case of honey intended to candy in bags or pails.*

The smaller illustration shows how the paper can be peeled off, leaving a nice solid brick of honey. On each paper package are printed directions for liquefying, reading like this:

The solid condition of this honey is proof of its purity. If preferred liquid, put it into a pail, and the pail into warm water, but not hotter than you can hold your hand in. NEVER LET IT BOIL, for boiling spoils the honey flavor. To remove the bag, cut from top to bottom, then peel it AROUND.

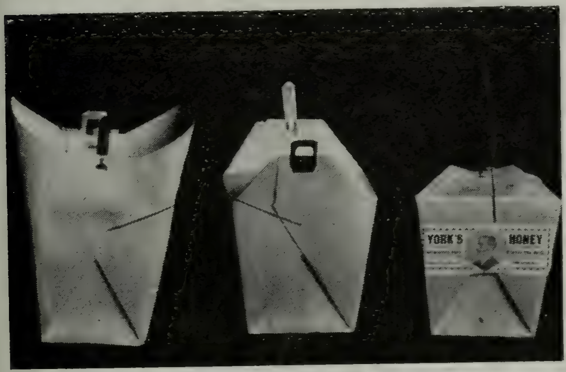
GRANULATED HONEY IN OYSTER-PAILS.

Another package, somewhat similar to the Aikin bag, is the ordinary oyster-pail. When honey begins to granulate it can be drawn off into pails of proper sizes, the covers put on, and the honey allowed to stand. In the course of two or three weeks in cool weather it should become quite solid; but it should be remembered that at an extremely cold temperature honey will not candy, but does so readily during alternately warm and cool weather. Oyster-pails have the advantage that beekeepers can buy them at any grocery, and they are almost as cheap as the Aikin paper bags. They have the merit, also, that honey can be sold in them in a practically liquid condition without fear of leaking.

They can also be handled quite roughly. If the honey should candy, all the better.

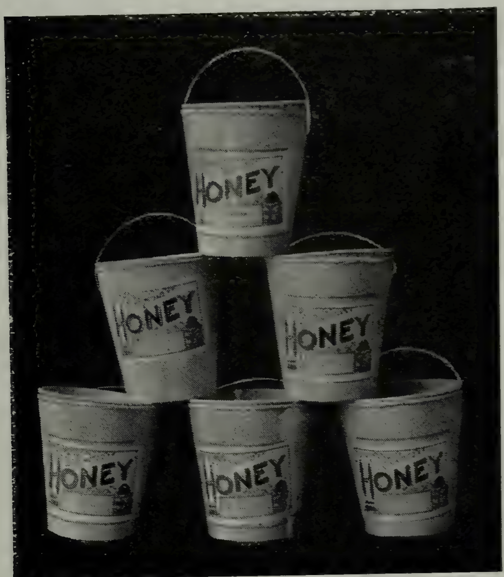
CUTTING CANDIED HONEY INTO BRICKS.

But honey in 60-lb. square cans that is granulated solid requires a good deal of treatment before it can be gotten out, put into bags, and candied again. The cans



Spuare oyster-pails for granulated honey.

must be first immersed in a boiler of water about 160 degrees, and kept there for hours at a time, before it melts enough to be poured out. Our honey-man, Mr. Jesse A.

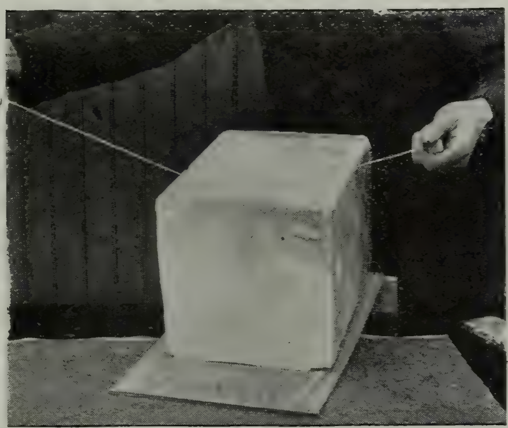


Round oyster-pails filled with granulated honey.

Warren, conceived the plan of stripping the tin away from the honey within, leaving it in the form of a solid cake. With a pair of snips he cuts off the top and bottom of the can, then slits it down at one corner. He next takes a strand of steel wire, attaching a handle to each end and slips it under the cake of honey about two inches. The wire is then folded around the cake, the two ends crossed, and with a handle in each hand the operator draws slowly, sinking the wire gradually into the cake from all four sides, until continuous pulling causes it to pass clear through. A thin-bladed knife is now inserted in the slit where the wire entered, and slabs off a chunk like that shown in cut next page. Other pieces are slabbed off in like manner. These are then cut up into bricks, using the same general plan—bricks all the way from 5 oz. up to 2 lbs. They are wrapped in paraffine paper, on which are general directions explaining how to liquefy.

CUTTING GRANULATED HONEY WITH A MACHINE.

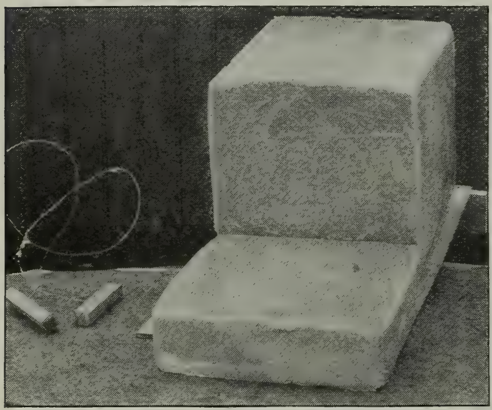
The plan just described can be used in only a very limited way. It has the fur-



Slab of honey nearly cut through by wire.

ther disadvantage that it is almost impossible to cut the cakes in regular sizes. A far better apparatus is the ordinary butter-cutter shown in the accompanying illustration, and sold by the Cleveland Galvanizing Works, Cleveland. The same thing, or something like it, can be obtained of any dealer in dairy supplies. This butter-cutter, as will be seen by the illustration, employs the same principle—a wire drawn taut for cutting butter. Since butter has about the same consistency as hard-granulated honey, the same machine will slice up a cake of granulated honey in uniform bricks, and do it more quickly and neatly than can possibly be done with a single strand by hand.

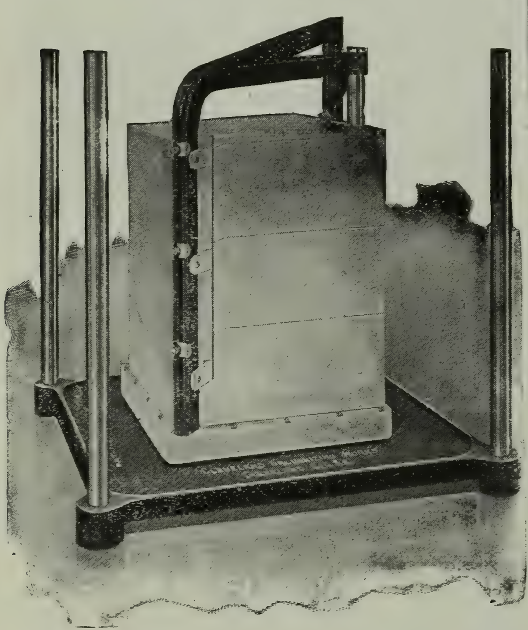
In using the machine, care should be taken not to crowd the frame holding the strands of wire too fast, as it is a job that



Slab of honey cut off.

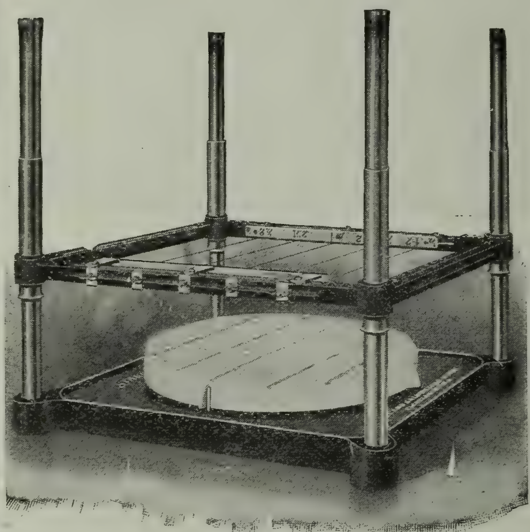
can not be rushed without danger of breaking the wires. A gentle continuous pressure is what is required.

For the perpendicular cuts a couple of heavy weights are applied in such a way that, after the cake of honey is put in place, the horizontal frame and its wires



Butter-cutter for cutting granulated honey into bricks.

gradually work their way through the mass. When the cake is cut the other way on the horizontal line, the operator takes hold of the gate, as it were, pulling gently. All that then remains is to take a thin-bladed knife, pick up each brick and lay it on a piece of paraffine paper. The brick is then neatly wrapped, when it is slipped inside of a special carton made just large enough to receive it. The carton is then covered with another wrapper, neatly lettered, and containing directions how to liquefy the honey when desired. As a rule, the consumer is advised to use the honey in the solid form by explaining that it can be spread on bread like so much butter.



Machine for cutting granulated honey.

Our people have found it advantageous to adopt the 1¼-lb. brick or 48 to the 60-lb. cake from the square can. It sells in our market from 25 to 30 cents retail, thus making a good margin on 10-cent honey.

CAUTION.

Do not attempt to cut the tin off from the can of candied honey unless the honey is very solid. If it is slightly mushy there will be trouble. The mass of candied honey will squash out of shape, and run all over every thing. There is no use in trying to cut up honey like this into bricks. It should either be melted or put into oyster-pails, where the process of solidifying can be completed.

It may be questioned whether it pays to cut off square cans and take the honey in a solid chunk; but it enables one to fill rush orders for candied honey on short

notice. Second-hand cans are worth only a few cents; whereas to melt the honey out and re-candy is out of the question.

GENERAL REMARKS ON HOW TO MAKE HONEY CANDY QUICKLY.

As we have already explained, continuous zero weather is not so favorable as weather somewhere near the freezing-point, now moderating up to the thawing-point,

Candied brick honey, wrapped ready for market.

then freezing, then thawing, etc. When the weather remains continuously cold, set the honey out in pails or bags in a room where the temperature goes a little below freezing, leaving it for a day or two, then bringing it into a warm room. After it is thoroughly warmed up, put it into the cold room again, and so continue with changes of temperature. Stir the honey occasionally, and always make it a rule to have some candied honey mixed with that which you desire to bring to a solid condition.

EDUCATING THE PUBLIC TO CANDIED HONEY.

The question may arise whether it would be everywhere practicable to sell granulated honey in any one of the forms described. It could hardly be deemed advisable to furnish buyers or commission houses knowing neither the shipper nor the real character of such honey. The packer or producer must first introduce it to his own customers—people who know him. The nature of the honey must be explained; how put up; that only the purest and best can be solidified in this manner; that it can be liquefied by putting the pail in water about as hot as the hand can bear, etc. In short, the trade must be educated to it. The fact that no unripe or glucosed honey can be put up in bags or bricks will be a strong "talking-point" on the purity of the honey. When the facts *once become known,* old prejudices give way.

A short time ago we cut up some brick honey with a wire into packages weighing 5 ounces. These sold for a nickel. They went off so fast we could not supply the demand. For the sake of experiment we cut up one 60-lb. can of candied honey into 160 cubes. The honey cost $6\frac{1}{2}$ cents per pound. We retailed these cubes at 5 cents each, or $13\frac{1}{2}$ cents a pound—doubling on our money.

After the trade gets educated to buying honey in this form no effort at all is necessary to sell it. The cost of the package is practically nothing, and all trouble from the honey candying again is overcome, because the trade has been educated to know that such honey is the pure article.

The time may come when candied honey will be known on the market as a common article of commerce; because when the public generally understands that such honey *must be of the best quality, and absolutely pure,* it will sell without any hesitation.

For particulars on how to prevent comb honey from granulating, see COMB HONEY.

H

HANDLING BEES. See Frames, to Manipulate; Anger of Bees; also Stings, and Hives.

HAULING BEES.—See Moving Bees.

HEARTSEASE. (*Polygonum Persicaria* L.). This is one of a large family of honey-bearing plants of which the common buckwheat is one. Heartsease, sometimes known as lady's thumb, knotweed, or heartweed, is naturalized from Europe, and widely distributed over eastern and central North America, particularly in Illinois, Kansas, and Nebraska. In the last-named State it reaches a height of from three to five feet, and grows luxuriantly on all waste and stubble lands. The flowers in clusters are generally purple, and, in rare instances, white. It yields in Nebraska, and other States in that section of the country, immense quantities of honey. One beekeeper, Mr. T. R. Delong, at the North American convention held in Lincoln, Neb., in October, 1896, reported that two of his colonies yielded each 450 lbs. of extracted, and that the average for his entire apiary was 250 lbs. per colony—all heartsease. While perhaps these yields were exceptionally large, quite a number of other bee-

A fine field of heartsease.

keepers reported at the same convention an average of 200 lbs. from the same source. When we visited Nebraska last there were acres and acres of this honey-plant over the plains as far as the eye could reach; and as it yields honey from August till frost, one is not surprised at the enormous yields.

The extracted honey varies in color from a light to a dark amber; and the flavor, while not quite up to that of white honey, is very good. Heartsease comb honey, in point of color, is almost as white as the clover. The extracted granulates in very fine crystals, and looks very much like the candied product of any white honey. Care should be taken in liquefying, as heartsease honey is injured more easily, and to a greater extent, by overheating, than any other kind.

HERMAPHRODITE BEES. These are nothing more nor less than freaks of nature—that is to say, we sometimes see worker bees having drone heads and drones with worker heads. They are not very common, it is true; but about once a year there is sent in to the authors specimens of either the one or the other kind of bees that have, apparently, appropriated the wrong head. The beginner needs to be reminded that the head of a drone is very different in appearance from that of a worker or queen. The two compound eyes of the former are large and well developed, while in the latter they are much smaller.

Under the heading of DRONES, to which the reader is referred, we mention another freak of nature—namely, drones with variously colored heads.

HIBERNATION OF BEES.—See WINTERING.

HIVE-MAKING. Unless one is so situated that freights are high, and unless, also, he is a mechanic, or a natural genius in "making things," he had better let hive-making alone. Hives can be bought, usually, with freight added, for a great deal less than the average beekeeper can make them himself, if we consider spoiled lumber, sawed fingers, and the expense of buzz-saws; and, besides, hives made in the large factories, where they are turned out by the thousands, by special machinery run by skilled workmen, are much more accurately cut, as a general thing.

The following letter from a practical planing-mill man, who ought and does know what he is talking about, sets forth the actual facts as they are:

ELIAS BAMBERGER,
Manufacturer of
SASH, DOORS, BLINDS
Contractors' and Builders' Supplies,
including all Kinds of Window Glass.
Cor. Exchange and Adams Sts.
Estimates Furnished on Application.

Freeport, Ill., June 11, 1907.

The A. I. Root Co., Medina, Ohio.

Gentlemen:—I received five of your A E525-10 hives yesterday, and find that I can not make my own hives and supplies as cheap as yours and use the same quality of lumber. You can see by the head of this letter that if any one can make hives cheaper than your prices or any of the so-called "trust hive" manufacturers, I ought to be able to do it; but, using the same quality of lumber, I can not. JOHN H. BAMBERGER.

But there is lots of fun in making things, even if they are not so well made; and there are some rainy or wintry days in the year, when, if one is a farmer, for instance, he can as well as not, and at little or no expense for time, make a few hives and other "fixin's." Again, if one lives in a foreign country he may not be able to get the hives that we shall recommend.

REQUISITES OF A GOOD HIVE.

While it is very important to have good well-made hives for the bees, we would by no means encourage the idea that the hive is going to insure a crop of honey. As the veteran Mr. Gallup used to say, "A good swarm of bees will store almost as much honey in a half-barrel or nail-keg as in the most elaborate and expensive hive made, other things being equal." This is supposing we had a good colony in the height of the honey season. If the colony were small, it would do much better if put into a hive so small that the bees could nearly or quite fill it, thus economizing the animal heat, that they might keep up the temperature for brood-rearing, and the working of wax. Again, should the bees get their nail-keg full of honey, unless more room were given them they would have to cease work or swarm, and either way a considerable loss of honey would be the result. The thin walls of the nail-keg would hardly be the best economy for a wintering hive, nor for a summer hive either, unless it were well shaded from the direct rays of the sun.

P. H. Elwood, of Starkville, N. Y., who owns over 1300 colonies, said in *Gleanings in Bee Culture,* April 15, 1891, "A good hive must fill two requirements reasonably well to be worthy of that name. 1. It must be a good home for the bees; 2. It must in addition be so constructed as to be convenient to perform the various operations required by modern beekeeping. The first of these requirements is filled very well by a good box or straw hive. Bees will store as much honey in these hives as in any, and in the North they will winter and spring as well in a straw hive as in any other. They do not, however, fill the second requirement; and to meet this, the movable-frame hive was invented."

Under the subject of HIVES, a little further on, will be shown styles and the special features that belong to each. But there is only one hive that is used largely throughout the United States, and that is the Langstroth—that is, it embodies the Langstroth dimensions. The frame is 17⅝ long by 9⅛ deep, outside measure. This establishes the length and depth of the hive. As to width, that depends upon the number of frames used. It is the rule to allow 5-16 bee-space between the ends of the frames and the inside ends of the hive. This will make the *inside* length of a Langstroth hive 18¼ inches, or the *outside* length 20 inches if made of ⅞-inch planed lumber. It is the rule to make the depth of the hive ⅜ inch deeper than the frame—⅛ inch under the frame and ¼ inch on top. For dry climates a greater allowance should be made on account of shrinkage. The selection of the frame, and the number to the hive, the distance they are spaced apart, then, determines the dimensions of the hive itself.

We said the Langstroth is the standard throughout the United States; but there has been a tendency on the part of a very few toward a frame of the same length, but two inches deeper. There is also a tendency to go to the other extreme in adopting a frame of Langstroth length, but two or three inches shallower, using two stories of such a hive for a single brood-nest.

On account of the diverse notions of beekeepers, and the peculiarities of locality, it would hardly be worth while to give general directions for the manufacture of any one hive; and, besides, no printed directions will give as good an idea of the construction of a hive as the very thing itself. For these and other reasons it would be far better for the one who intends to make hives to send to some manufacturer for a sample in the flat, all complete. With the several pieces for patterns he will then know exactly the shape and dimensions, how to make the rabbets, and in general how the hive is constructed in every detail. If one does not find on the market just such a hive as suits his notion, of course he sees, or thinks he sees, "in his mind's eye" just what he wants to make; but in that case we would advise him to make a sample or two before he makes very many of them; for nine times out of ten—yes, ninety-nine times out of one hundred—he will discard the one of his "own get-up," and adopt some standard made by manufacturers generally.

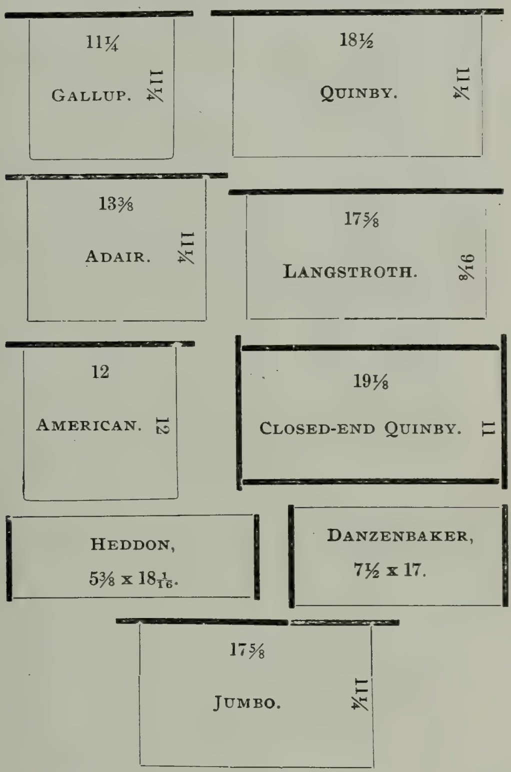
HIVE ON SCALES. See SCALE HIVE.

HIVES based on Langstroth dimensions are the standard. Some thirty years ago there were in use the American, Gallup, Langstroth, Adair, and Quinby frames. All of these required, of course, hives of different dimensions. Between the Adair, the Gallup, and the American there was but very little difference, comparatively, as they were square, and very nearly of a size. The Langstroth was long and shallow—the shallowest frame that had then been introduced; and the Quinby, having about the same proportions, was the largest frame in general use. By consulting the diagram containing the different sizes of frames it will be seen that there are practically two classes—the square and the oblong. As there would be but very little difference, theoretically and practically, between the results secured with a Gallup, American, and Adair, we will consider the arguments for the square frame.

SQUARE FRAMES.

In nature, bees have a tendency to make a brood-nest in the form of a sphere; patches of brood are more inclined to be circular than square or oblong. Theoretically, then, a circular frame would be the best; but as that would not be practicable, owing to the difficulty in the construction of the frame and hive, obviously the square

frame would come the nearest in conforming to nature and a perfect cube for the hive. The square frame, as a rule, called for a hive in the exact shape of a cube. If, for instance, the frame was 12 inches square, outside dimensions, then the hive, if the combs were spaced $1\frac{3}{8}$ inches apart, and $12\frac{3}{4}$ inches wide inside, should take in just nine American frames. Such a hive, it was argued, would conserve the heat of the bees to the best advantage, would give



the greatest cubical contents for a given amount of lumber—barring, of course, the perfect sphere. As it economized heat in winter, it would winter bees better than a hive having oblong frames.

All of this seemed to be very pretty in theory; and there are some users of square frames who insist that the theory is borne out by actual experience. But the great majority of beekeepers, after having tried the square and the oblong frame, finally decided in favor of the Langstroth for the following reasons:

THE LANGSTROTH FRAME AND HIVE, AND WHY THEY BECAME THE STANDARDS.

1. A shallow frame permits the use of a low flat hive that can easily be tiered up one, two, three, and four stories high. This is a great advantage when one is running for extracted honey, as all he has to do when the bees require more room is to add upper stories as fast as the bees require them, and then at the end of the season extract at his leisure. Square or deep hives can not be tired up very high without becoming top-heavy and out of convenient reach of the operator.

2. The long shallow frame is more easily uncapped because the blade of the uncapping-knife can reach clear across it.

3. The shape of the Langstroth frame favors an extractor of good proportion.

4. A deep frame is not as easily lifted out of a hive; is more liable to kill bees in the process of removing and inserting frames.

5. The shallow frame is better adapted for section honey. It is well known that bees, after forming a brood-circle, are inclined to put sealed honey just over the brood. In a frame as shallow as the Langstroth, there will be less honey in the brood-nest and more in the boxes; for bees, in order to complete their brood-circle in the Langstroth, will, with a prolific queen, often push the brood-line almost up to the top-bar, and, consequently, when honey comes in, will put it into the supers or boxes just where it is wanted.

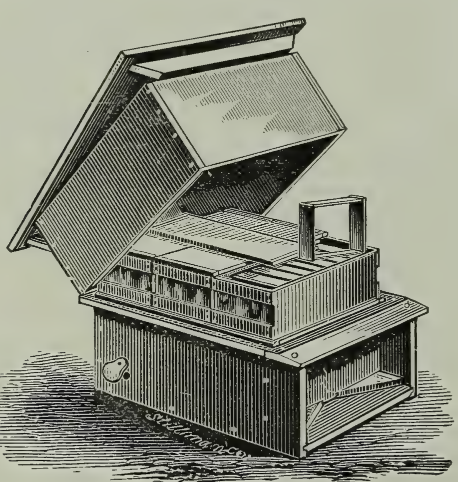
6. When bees are left to themselves they will generally form a cluster late in the season, immediately over the entrance of the hive, and down two or three inches from the top of the frames. As the season progresses the cluster eats into the stores above it; and on reaching the top it works backward. It therefore transpires that the cluster reaches the top of the hive where it is the warmest during the coldest part of the year. In the case of the ordinary square frame the bees will be found just over the entrance, but four or five inches from the top; but in the midst of the coldest weather the bees may not and probably will not be near the top of the hive; but on reaching the top they can progress backward only a comparatively short distance because the top bar of a square frame is relatively short. In the case of the Langstroth hive, the bees during the entire cold part of winter stay in the top of the hive, where it is the warmest. As the stores are consumed they move

backward and gradually reach the back of the hive, and by that time warmer weather will probably prevail.

But in actual experience bees seem to winter just as well on a Langstroth as any other; and as the shallow frame is better adapted to section honey, beekeepers naturally turned toward the shallower frame, with the result that now probably nine-tenths of all the frames in the United States are of Langstroth dimensions; and whatever advantage there may be in favor of the square shape, the beekeeper is able to buy standard goods so much cheaper that he adopts the Langstroth frame.

FRAMES SHALLOWER AND DEEPER THAN THE LANGSTROTH.

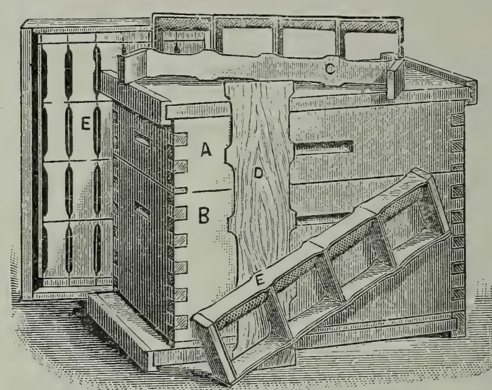
A few years ago there was a tendency toward a frame still shallower than the Langstroth, and what is called the Heddon; but as eight or ten of these frames, or one section, make too small a brood-nest, two sets of such frames are used to accommodate a whole colony. Of the Heddon hive we shall have more to say later on.



The original Langstroth hive.

There is a very small class of beekeepers who feel that the Langstroth is not quite deep enough, and who, therefore, prefer the Quinby. They argue that ten such frames, or frames Langstroth length, and two inches deeper, are none too large for a prolific queen, and that these big colonies swarm less, get more honey, and winter better. Of these latter, we shall have more to say under the subject of "Large vs. Small Hives."

The old original Langstroth hive that father Langstroth put out contained ten frames $17\frac{3}{8}$x$9\frac{1}{8}$.* Each hive had a portico, and cleats nailed around the top edge to support a telescoping cover, under which were placed the comb-honey boxes, or big cushions, for winter. There was a time when this style of hive was the only one used; but owing to the fact that it was not simple in construction, that the portico was

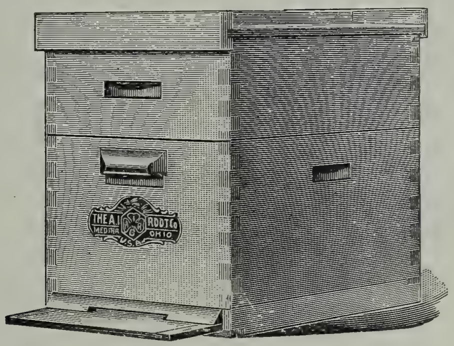


Modern hive based on Langstroth dimensions.

a splendid harboring place for cobwebs and gave the bees encouragement for clustering out on hot days instead of attending to their knitting inside of their hives, a far simpler form of hive was devised. The Simplicity, first brought out by A. I. Root, having Langstroth dimensions, was the result. Instead of having telescoping covers the contiguous edges of the hive were beveled so as to shed water and give in effect a telescoping cover. The cover and bottom of this hive were exactly alike, the entrance being formed by shoving the hive forward on the bottom, thus making an entrance as wide or narrow as seemed most desirable. The upper story was exactly the same as the lower one or brood-nest—so, taking it all in all, the hive was simplicity itself. But it had one serious defect, and that was the beveled edge. It was found to be practically impossible at times, on account of the bee-glue, to separate the upper story from the lower one without breaking or splitting the bevel. Finally there was introduced a hive very much the same, having straight square edges, and along with it came the feature of dovetailing or locking the corners, as shown in the hive above.

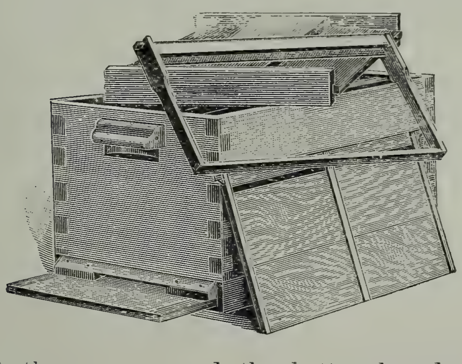
* The length for nearly 50 years has been $17\frac{5}{8}$ instead of $17\frac{3}{8}$.

This hive was introduced in 1889, and seemed to meet with the general approbation of beekeepers. It embodied in tb main the Langstroth dimensions, but used eight instead of ten frames; for at the time it was introduced, nearly every one preferred eight frames. The original Dovetailed hive had a flat cover, and a bottom-



board made the same as the cover, except that there were side-cleats to raise the hive off the bottom-board.

Since that time there have been modifications of the hive, and it is now made in eight, ten, and twelve frame sizes. While the eight was used almost exclusively, yet at the date of the present edition (1912) the ten-frame size bids fair to run out both the eight and twelve frame widths. The cover is made of six pieces. The body is locked

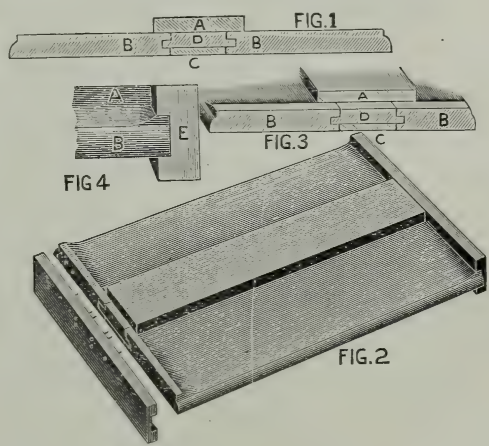


at the corners, and the bottom-board is made in several styles. See ENTRANCES.

The Hoffman self-spacing frame, described under FRAMES, SELF-SPACING, and FRAMES, MANIPULATING, is used in the Dovetailed hive almost exclusively. The supers for this hive are the same as those shown under COMB HONEY.

As now constructed the hive embodies the very latest developments in hives and hive-construction. It can be handled rapidly, and is especially adapted for out-apiary work, where frequent moving from one field to another is necessary. It is standard, being made by all the supply-manufacturing concerns, and is for sale everywhere. The lock corner is especially well adapted for hot climates; and for any place it is far superior to work depending on nails alone. The ordinary miter or halved joint is inclined to pull apart in parts of California, Texas, Florida, and other portions of our country subject to extremes of heat, or hot dry winds.

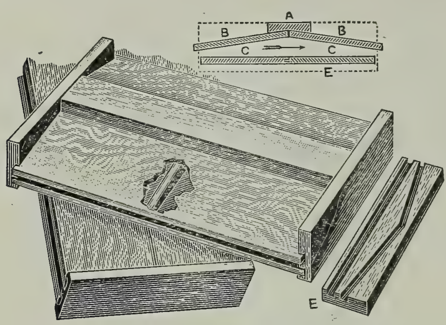
A very important requisite of a good hive is a good cover. While the flat cover —one making use of one flat board and



Excelsior flat cover.

two cleats—was a good one, yet, owing to the width of the single board, and increasing scarcity of such lumber, something made of two or three narrow boards had to be used. Accordingly, the Excelsior was devised. It consists of boards not exceeding 6 inches in width, because narrow boards can be easily secured, and because they will not shrink and check under the influence of the weather like the wide ones. The two side boards, B, B, are beveled or chamfered on one side so that one edge is left only about one-half the thickness of the other edge, but the ends are left full thickness of the boards to shed water away from the edge and to give more nail-grip for the grooved end-cleats, E, that slip over and bind the whole together. The purpose of the chamfering is to shed water to the sides of the hive and away from the center-piece, AD, which is tongued and grooved to fit a corresponding tongue and

groove edge of the two side-boards that were beveled to shed water. The space under D is filled with a thin board ¼ inch thick, the ends of which project into the ⅞-inch groove of the end-cleats, E, where it is securely held in place.



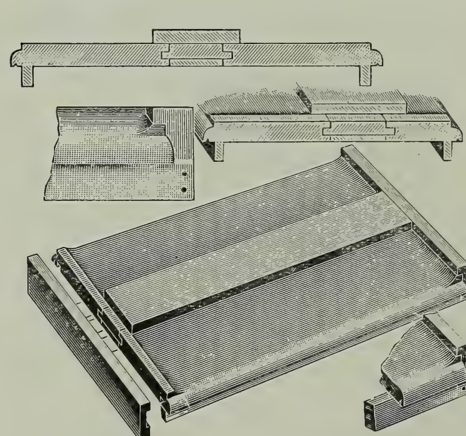
Gable cover.

In very hot climates a beveled or gabled cover is used. The lower part of the cover is flat, and the upper part gabled, as shown in the accompanying illustration.

TELESCOPE COVERS.

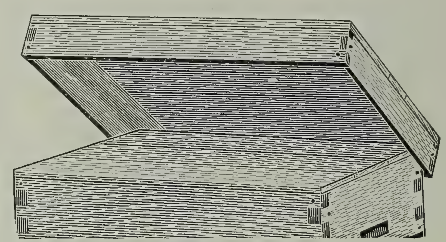
There is a strong tendency at the present time toward a double or telescopic cover, as is shown in the accompanying illustrations.

The lower cover consists of two or more boards ⅜ inch thick, bound at the ends by means of a galvanized channel iron, with the legs of the U, so to speak, bent inward.

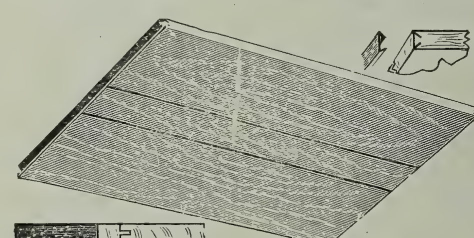

Excelsior cover with telescoping sides.

This metal is slipped into corresponding sawcuts in the ends of the boards. Such construction permits of shrinking and swelling due to change in weather conditions. It lies directly over the frames, and over this is placed a shallow telescoping cover made of ⅜ lumber, and covered with sheet metal or roofing paper.

A top protection of this sort is not only better than a single-board cover, but it shuts out the weather. The air-space between the two covers gives the bees better protection from the direct rays of the hot sun if the hives are out in the open, and,


Telescope cover.

if kept painted, will last indefinitely. The lower cover will be sealed down by the bees, and the upper one can not blow off because the downwardly projecting sides will hold it in place. Of course such an arrangement makes extra handling in open-


Super cover.

ing and closing the hive; but the majority of beekeepers are beginning to see that this is more than offset by the greater durability and better protection.

HIVES WITH CLOSED-END FRAMES.

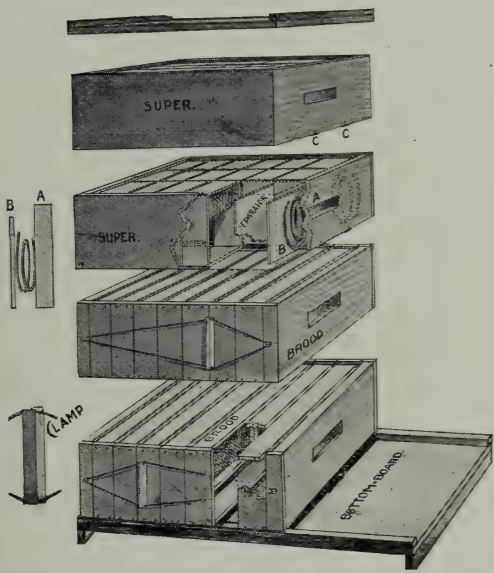
Under Frames, Self-spacing, we have spoken of the Quinby, as that is the one used in Central New York, especially in Herkimer and Otsego counties. But in this department we shall have more to do with the subject of closed-end frames, certain principles of their construction, and their adjustment in several of the best hives.

Closed-end frames may be divided into two classes—the standing and suspended. The Quinby, already spoken of under Frames, Self-spacing, the Bingham, and the Heddon, are of the first-mentioned class; the Danzenbaker, to which we shall

soon refer, belongs to the latter class. It is generally considered that frames with closed uprights, while not as convenient, perhaps, for general manipulation, are better adapted to wintering. Frames partly closed end, like the Hoffman, or open all the way up, like the ordinary loose hanging frame, permit of currents of air around the ends of the frames, and (it is claimed), as a consequence, bees are not so much inclined to bring their brood clear out to the end-bars as they do when closed ends are used. Experience shows in our apiaries that there is something in this. See DANZENBAKER HIVE under this head.

THE BINGHAM HIVE.

Mr. Quinby was the first to apply Huber's principle of closed-end frames in this country (see HIVES, EVOLUTION OF).



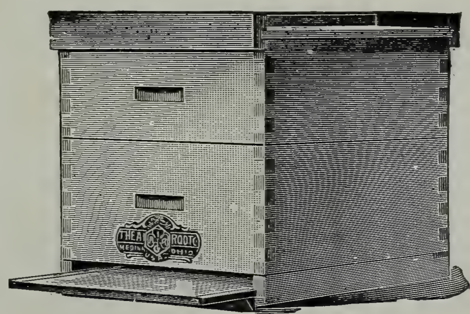
This he introduced shortly after the appearance of the Langstroth hive. Almost contemporaneously Mr. Bingham in 1867 brought out his hive with closed-end frames with a narrow top-bar and no bottom-bar, but still embodying the chief features of Huber's hive of 1789. But the peculiar feature of this hive was that it made use of shallow frames only 5 inches deep, a series of them being lashed together by means of a wire loop and stretcher sticks, said loop drawing on the follower-boards in such a way as to bring tight compression on frames inclosed in the manner shown. Seven of these brood-frames in the present hive make up a brood-nest, and an entire brood-nest may consist of one or two sets of frames. The top-bar is dropped down from the top of the end-bars a bee-space, while the bottom-bars (which Mr. B. now uses) are flush with the bottoms of the end-bars. With a bottom-board having a $\frac{3}{8}$-inch strip on each side, the ordinary bee-space is preserved through the several divisions of the hive.

The super is like any ordinary one adapted to comb honey, except that it uses coiled springs to produce the necessary tension.

Although Mr. Bingham has used this hive for a great many years, and quite successfully too, no one else seems to have done much with it; but a modification of the hive is shown in the Danzenbaker and the Heddon, both of which, in some sections, have come to be favorites.

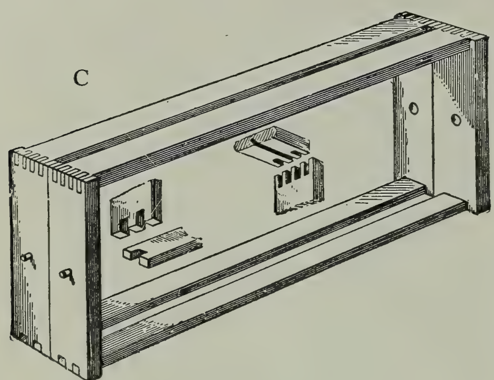
THE DANZENBAKER HIVE.

The Danzenbaker consists of a brood-chamber of the same length and width as ten-frame Langstroth Dovetailed hive, but deep enough to take in a depth of frame of only $7\frac{1}{2}$ inches. The rabbet, instead of being near the upper edge, is dropped down about midway; or, more strictly speaking, there is a cleat or board nailed on the inside of the ends of the hive, as shown in F F in the diagram, next page. On this support hang the closed-end brood-frames, pivoted at the center of the end-

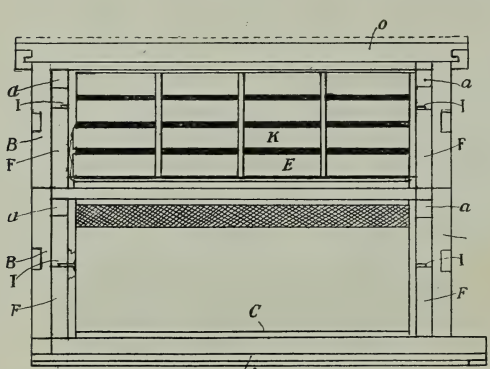


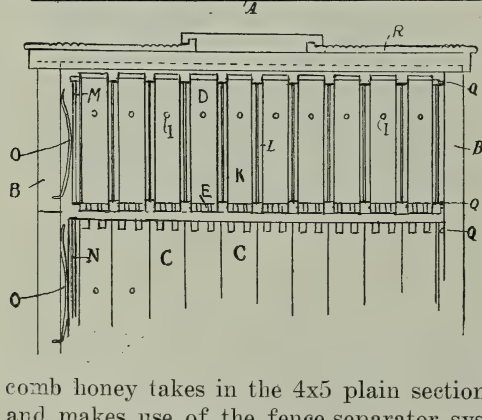
bars by means of a rivet driven through from the inside, as shown at I in the diagram. Ten of these frames fill the hive; and when they are crowded together with a follower-board on the side, we have practically a double-walled hive—the ends of the frames with closed uprights forming one wall, and the ends of the hive the second or outer wall; the follower on one side wall,

and the side of the hive the outside or secondary wall. These frames being pivoted in the center, as shown at C, can be reversed; and this feature, while it costs nothing, is something to be desired, as it enables us to have all frames filled solid with comb.



The bottom of these hives is the same as that shown for the Dovetailed, already described; or, to be more exact, the Dovetailed hive has appropriated the bottom-board of the Danzenbaker. The super for





comb honey takes in the 4x5 plain section, and makes use of the fence-separator system. The sections are supported in section-holders; indeed, the whole arrangement is the same as the section-holder super already described in COMB HONEY.

This hive is especially adapted to the production of comb honey, and Mr. Danzenbaker prefers to use only one brood-chamber at a time, although in some localities it might be better to use two. The ordinary Langstroth frame is just deep enough to permit of the bees building from an inch to an inch and a half of honey over the brood in each frame. Mr. Danzenbaker made this frame just enough shallower so that it will be almost solid with brood, and the honey that would otherwise be put in the brood-chamber is forced into the sections just where we want it, and where it will bring the highest market price.

ITS GOOD WINTERING QUALITIES.

Under FRAMES, MANIPULATING, will be found a description of how the frames of this particular hive may be handled without killing bees—to this the reader is referred.

The Danzenbaker hive seems to be especially adapted for wintering and springing bees. It is, to a great extent, double-walled, and the closed-end frames make the hive a warm one.

THE HEDDON HIVE.

This hive was patented and introduced by the late Mr. James Heddon, of Dowagiac, Mich., in 1885. Its peculiar and distinguishing feature is in the use of one brood-chamber divided into halves horizontally, each half containing a set of eight closed-end close-fitting brood-frames, 5⅜ in. deep by 18 1-16. The end-bars, as already stated, are close-fitting—that is, the brood-frame slides into the hive with just enough play to allow of its easy removal and insertion. On the bottom inside edge of the ends of each case are nailed strips of tin to support the frames, and the whole set of eight are squeezed firmly together by means of wooden thumbscrews as shown. Under the head of COMB HONEY we have already spoken of the value of compression for squeezing sections or section-holders or wide frames. The more tightly the parts are held together, the less chance there is for bees to chink propolis into the cracks.

The bottom-board of this hive is much like that used on the standard hives, in that it has a raised rim on the two sides

and ends, to support the brood-chamber a bee-space above the bottom-board, and at the same time provide for an entrance at the front. The cover is the ordinary flat one-board, cleated at the ends.

The purpose of the inventor in having the hive divided in this way was to afford more rapid handling, and to accomplish contraction and expansion by simply taking from or adding to the brood part of the hive one or more sections. This divisible feature of the hive, according to its advocates, enables them to handle *hives* instead of *frames*, to find the queen by shaking the bees out of one or both of the shallow sections. The horizontal bee-space through the center of the brood-nest is considered an advantage in wintering, in that the bees can move up and down and laterally through the combs.

However, this hive has been gradually going out of use, so that to-day there are but comparatively few that have it.

HAND DIVISIBLE-BROOD-CHAMBER HIVE.

Mr. J. E. Hand, of Birmingham, O., uses a hive embodying some of the basic principles of the Heddon, but with some improvements which, in his opinion, render it simpler, cheaper, and more practicable and workable. In the first place, he simplified it by making the brood-chamber of the same depth and general construction as the super for containing sections. In doing this, instead of making the brood-chamber deeper than the super, as did Mr. Heddon, he cheapened the hive by making each division or section of it one and the same thing in every respect. Instead of using thumb-screws, which will very often swell in damp weather so as to become immovable, making it impossible to remove the frames, he made one side of his super or

J. E. Hand's sectional hive.

brood-chamber with a removable follower-board, the same being secured in place with a pair of ordinary Van Deusen hive-

Side of upper section detached to show construction. Hilton's two-story claff hive.

clamps. By consulting the engravings herewith one may readily understand the principle; but the removable follower-

board is only three-fourths as wide as one side of the brood-chamber, the remaining space being taken up by a permanent wooden strip which securely holds the two ends and the sides in position. The follower-board, as will be seen, is cleated on the inside; and on the opposite side are two super springs, just opposite the uprights of the brood-frames or section holders, as the case may be. When sections or frames are in place, the follower-board closes up the open space, where it is secured in place by two Van Deusen clamps that crowd it up against the brood-frames or sections which, in turn, bear against the springs. No matter what the weather conditions may be, the yielding springs will cause a pressure on the frames or sections, and yet allow removing them with the greatest of ease. The brood-frame is $4\frac{7}{8}$ inches deep by $17\frac{5}{8}$ long. The section-holders are the same size, containing $4\frac{1}{4}$ plain sections with fences.

THE DADANT HIVE.

Almost the very opposite of the Heddon in principle and general construction is the Dadant hive. While Mr. Heddon divides up the brood-chamber into one, two, or three separate portions, Mr. Dadant would have it all in one large complete whole. His frames are $18\frac{1}{2}$x$11\frac{1}{4}$—that is to say, they have the Quinby dimensions, and he uses nine or ten to the hive. Such a hive has about the equivalent capacity of a twelve-frame Langstroth, regular depth. The Dadants have always insisted that their ten-frame Quinbys, when compared with the ten-frame Langstroths, averaged up year after year, would give far better results, both in honey and in economy of labor. This opinion is not based on the experience of two or three years, but on a period covering a good many years. The large hives, they claim, swarm less, produce more honey, and winter better. If we are correct they do not, at their home yard at least, have to exceed two per cent of swarming, and this average has been maintained year after year. Apparently the colonies in these large hives have very little desire to swarm; but when they *do* swarm the swarms are enormous. In regard to this point, in an article that was published in *Gleanings in Bee Culture*, Nov. 1, 1898, C. P. Dadant says:

Don't understand me to say that, with large hives, you will have no swarms, for this is incorrect; but if you want to prevent swarming, to the greatest possible extent, you must, first of all, have large hives. Other things are required, such as the removal of the excess of drone combs, plentiful ventilation, a supply of surplus combs, etc.; but the *sine qua non,* in our eyes, is large hives.

With a little care it is not difficult to keep swarming down to such a point that the natural increase will barely make up for winter losses. In our case we find it insufficient, and we resort to artificial swarms, or dividing, which we find much more satisfactory, for we can breed from the queens that we prefer, and, at the same time, keep our best colonies for producing honey. Every practical beeman will agree that it is the large colonies that give the large crops, whatever ma-be his opinion as to the size of hive needed.

But if we *must* have swarms, with large hives they will be large, take my word for it.

The Dadants have claimed that the ordinary eight and ten frame hives are not large enough for good prolific queens; that a brood-frame of Langstroth depth is too shallow; that we never know what a good queen can do till we give her a large hive and a large frame. Again, in one of their articles for Oct. 1, 1898, in *Gleanings in Bee Culture,* Mr. C. P. Dadant says:

With the large hives we found queens that had a capacity of 4500 eggs per day. Exceptions, you will say? Certainly, but it is a very nice thing to give a chance for those exceptions. And I hold that you can not do this as fully with a two-story eight-frame hive as with a hive that may be enlarged, one frame at a time, till it contains all the room that the queen may need. Your eight-frame hive gives her too much room at once when it is doubled in size. If the season is a little cool, there is a chance of delaying the breeding by chilling the combs. The bees will then concentrate themselves upon the brood and keep it within narrow limits, for the queen will seldom go out of the cluster to lay.

As to the matter of wintering, these jumbo hives seem to offer exceptional advantages. Mr. Dadant, in one of his articles, says:

The facts upon which I base my conclusion are those that we have seen under our own eyes, of better success in wintering the large deep hive. . . We have thus stronger colonies for winter, which is in itself a great advantage, as the number of bees has much to do with their ability to keep warm, and their ability to retain the heat has also much to do with their honey consumption. A weak colony suffers much from the cold, and is compelled to eat more. . . But to me the greatest advantage of the deep large frame is the greater ease bees have in reaching the honey while preserving a more compact cluster.

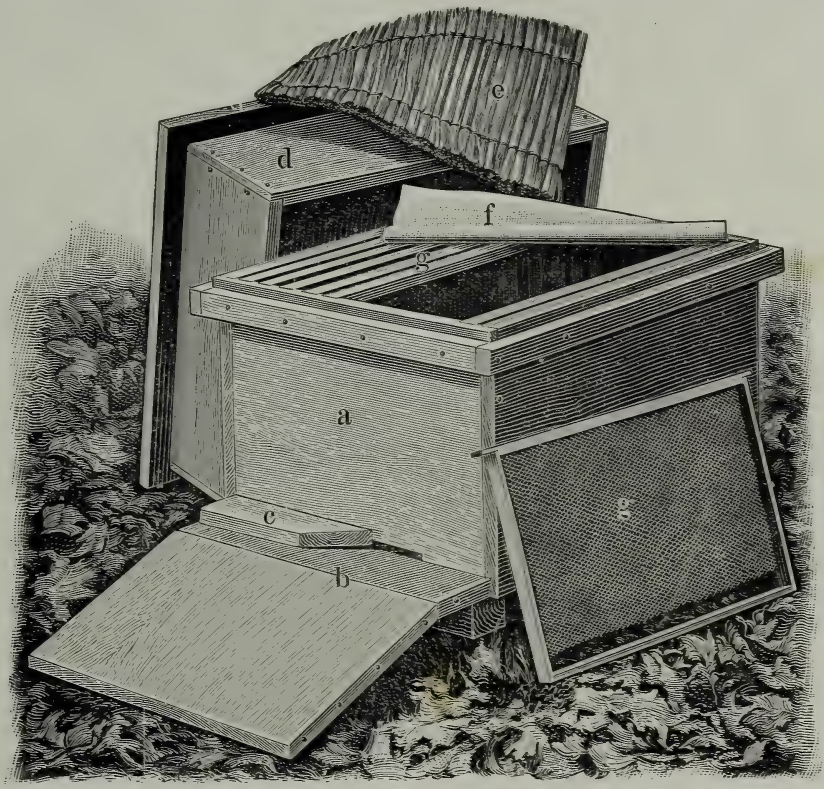
LARGE HIVES; WHERE AND UNDER WHAT CIRCUMSTANCES USED.

The Dadants have a considerable following in their vicinity; and in France the Dadant-Quinby has become almost the standard hive. But it should be remembered that the Dadants are extracted-honey

men; and in France liquid honey has rather the preference. There can be no sort of doubt that these large hives, for *extracted* honey, have some advantages over the smaller ones; but when it comes to the production of *comb* honey, then there is a question, and a big one, too: Is such a large hive as good as a smaller one? In some localities the bees might fill only a brood-nest in such a hive; whereas if a shallower one were used, like the Danzenbaker or Heddon, the available comb space below would be filled with brood; and the honey, when it did come in, and what little there was of it, would be forced into the supers.* In the selection of a large hive, then, a good deal depends on the locality, and whether one proposes to run for comb or extracted honey.

THE LARGE HIVES NON-SWARMERS.

There is one very important feature in favor of the Dadant hive, and, in fact, any large hive; and that is, the reduction or almost entire control of swarming. There has been no satisfactory method proposed to accomplish this result with the single-story eight-frame Langstroth when run for the production of comb honey; and a great many give up the problem, stating that it is better to let the bees swarm once, and then somehow afterward control the after-swarms, arguing that more actual comb honey will be produced from the parent colony and its swarm than where other methods are employed. But if swarming is to be allowed, what is to be done at outyards? If an attendant has to be constantly on hand during the swarming part of the day, it means a big expense, and this might, in a poor season, balance the entire proceeds of the honey crop. If, on the other hand, swarms are allowed to go to the woods, then there is a loss. It is true that swarms will not escape if the queens' wings are clipped; and to a very great extent clipping does prevent this waste.* But better—far better—is it to



Dadant-Quinby hive.—*From "Langstroth on the Honeybee," revised by Dadant.*

* Properly queened, the large hives have immense populations and combs *full of brood*, and the great field force will make a much better showing in the supers than it is possible to obtain by forcing the small-hive colonies, regardless of the volume of flow.—A. C. M.

* See CLIPPING QUEENS' WINGS TO PREVENT SWARMING, under head of QUEENS; also SWARMING.

take away the desire for swarming altogether, *if* it can be done. In the production of extracted honey, at least, the Dadants have demonstrated that, with their large hives, they have practical control of swarming, because their hives are so large that the bees and the queens rarely feel cramped for room. But Mr. Dadant argues that he would use large hives, even if he were running for *comb* honey; for with a division-board he can reduce the brood-chamber to any size desired. And then when he has a prolific queen that can fill a whole Quinby hive he is that much ahead, because the colony has more working bees to its size than a smaller one; and there is no use in denying the fact that these jumbo colonies have a certain vim and energy—a day-after-day "stick-to-it-iveness"—that we do not find in the smaller ones. Personally we believe in large colonies; and we are hopeful that the time will soon come when we shall learn how to make these big colonies produce comb honey as well as, at the same time, remaining practically non-swarmers. At the present time (January, 1913) shallow hives, like the Langstroth, have the almost exclusive preference for comb honey throughout nearly all the territory in the northern portion of the country—the territory where the main honey supply is almost entirely from clover and basswood.

LARGE COLONIES IN TWO-STORY EIGHT-FRAME LANGSTROTH HIVES.

We have experimented a little with two-story colonies in eight-frame Langstroth hives tiered one above another, raising brood in both stories. When we have a good queen, such colonies in these double chambers grow to be tremendously strong, and they show less inclination to swarm—no sort of doubt about that; and, what is more, in a few instances we have placed comb-honey supers on top of these same colonies, and had them fill two and three supers. But in a majority of cases the colonies will not be strong enough to fill two stories and go into the supers besides; so, after getting the colonies up to good strength, and just at the approach of or during the honey-flow, we take away one story and place on one or two comb-honey supers. Such a large force of bees, of course, rush right into them; then if there is any honey in the fields the supers are filled and completed in short order. We have thus far succeeded in getting stronger colonies in this way than in a single eight-frame brood-nest alone. By thus breeding in double stories, and having prolific queens, or, perhaps, what may be better, working colonies on one eight-frame full-depth story, and one eight-frame half-depth story, we can get the bees into the sections at once. For particulars regarding this last, see the Barber plan spoken of under COMB HONEY.

OBJECTIONS TO LARGE HIVES.

Their size renders them both heavy and unwieldy. They cost more money—about twice as much if made as shown in the engraving of the Dadant hive. It is difficult, in the first place, to get good clear lumber wide enough to make these deep hives; and then when they are made, and are full of bees and honey, it is not practical to move them about much. The Dadants, for instance, leave these large hives on their stands all summer and winter, both at the home and out yards. They find it more practical to do so. Even when wintered on their summer stands in single-walled hives, the loss, we understand, just about equals the slight increase they have in swarming.

These large frames are not nearly as easy to manipulate as the shallow Langstroth. It takes longer to get them out of the hive, and during the operation there is more danger of killing bees. The Dadants and others having the Quinby hive find it necessary to use another size that they call their shallow or half-depth frame, $5\frac{3}{8}$x$18\frac{1}{2}$, for extracting. These are placed on top of the brood-nest, and are tiered up one, two, three, or four high. One is led to wonder why a compromise between a deep Quinby and these extracting-frames would not be better—a frame adapted for breeding as well as for extracting—as, for instance, one like the Langstroth; then when one wants a large hive he can tier up one brood-chamber on top of the other.

THE TEN-FRAME LANGSTROTH HIVE OF EXTRA DEPTH.

It was suggested by A. N. Draper, formerly of Upper Alton, Ill., one of Mr. Dadant's followers, that, in order to reduce cost, instead of making a hive after the

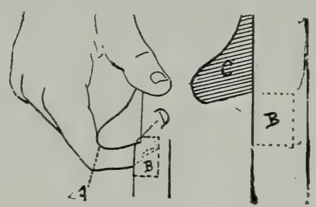
Quinby dimensions, and on the Dadant pattern—the former being odd-sized and the latter expensive to construct—a hive be constructed after the pattern of the regular ten-frame Dovetailed, having Langstroth dimensions save in one measurement—that of depth. He would add to the hive and frame $2\frac{1}{8}$ inches. As the Dadants ordinarily use nine frames in their Quinby hives, ten frames $2\frac{1}{8}$ inches deeper, with Langstroth top-bar, would give the hive equal capacity. Such a hive would take regular Langstroth ten-frame bottom-boards, cover, supers, honey-boards, winter-cases—in fact, every thing adapted to the regular ten-frame Langstroth Dove-

The comparative difference in size between a regular eight-frame hive and a ten-frame jumbo.

tailed hive. As the ten-frame hive is one of the standards, it seems reasonable to suppose that, if the large hive is really better, such a hive would be more simple, and cost less, than to adopt regular Quinby-frame dimensions, and make the hive as the Dadants show it. Indeed, we have been told that the Dadants would favor such a hive rather than the one they have adopted, if they were to start anew. Your supply-dealer will make the brood-chamber for about 25 per cent more than the regular ten-frame Langstroth Dovetailed; the super, covers, and bottom-boards would, of course, cost no more. Where one by reason of locality or preference desires such large hives, the Jumbo ten-frame Langstroth of extra depth, suitable for taking standard ten-frame fixtures, is the hive to select.

CLEATS V. HAND-HOLES.

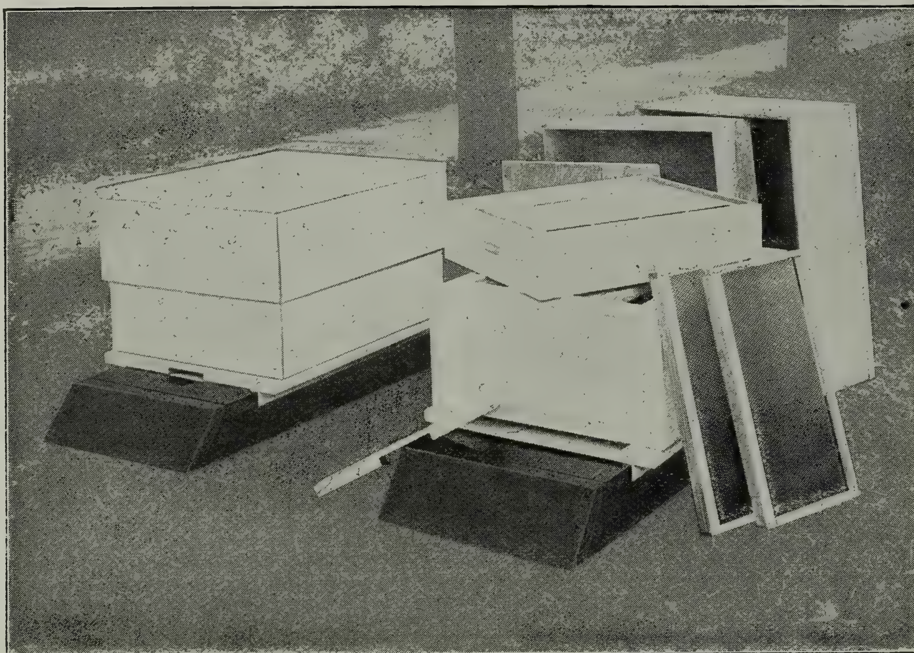
By referring to the illustration of the original Langstroth hive, and also to the illustration of the Dadant hive, one will see that they have cleats or rims running all around the hive near the top edge. These serve the double purpose of supporting the telescopic cover and affording



convenient handles by which to lift the hives; but on account of the expense, these cleats running around the hive were in later years abandoned, and hand-holes, made by means of a wabble-saw, were used. But these hand-holes, while very neat and cheap, did not begin to afford the excellent grip that one secures when getting hold of a seven-eighths inch cleat. A far better arrangement than either is a combination of cleat and hand-hole, as shown in illustration of the Dovetailed hive, and the cuts opposite. A short strip of $\frac{7}{8}$-inch molding is nailed just above the hand-hole so that the fingers get a double grip. In the accompanying diagrams the reader will see the advantage of this arrangement. Referring to the diagram at D, when one lifts by the hand-holes alone he lifts by the tips of the fingers only; and when the hive is heavy, the strain on the fingers is severe and often painful. But if he can get the greater part of the weight on the middle joints of the fingers, as shown at A, and on a rounding edge, he can lift all his back will stand. The cleat alone would not give room enough for the fingers to permit of the grip on the middle joints, as shown at A; but when the side of the hive is recessed by the hand-hole, it allows of the fingers being shoved to a point to get the best possible grip. If one expects to use heavy hives, then he needs some such arrangement as this. The cost is insignificant, and the advantage great.

DOUBLE-WALLED OR CHAFF HIVES.

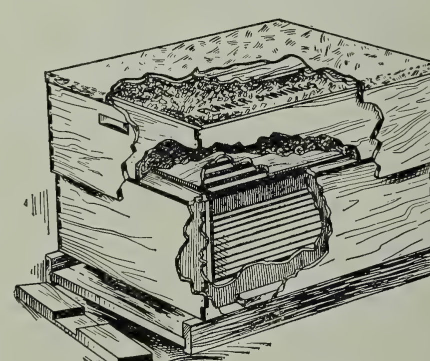
The hives that we have thus far described are what may be called single-walled hives; that is, the outer shell or case consists of a single-board thickness of lumber. Such hives, as a rule, unless as



Root double-walled hive with removable bottom.

large as the Dadant, can not very well be wintered outdoors on their summer stands. They either have to be carried into the cellar at the approach of cold weather, or else have to be put in outside packing-cases, as the single walls hardly afford sufficient protection to enable the average colony to go through the winter safely, or without great loss both in bees and in stores. The poorer the protection, the greater the consumption of winter food. A colony poorly protected outdoors will probably consume twice as much as one adequately protected.

In the South, of course it is not necessary to carry the single-walled hives into the cellar or winter repository; but north of latitude 40, hives of single-board thickness either ought to be housed or protected with winter cases. Where one from choice or necesstiy has to winter outdoors, what are known as double-walled or chaff hives should be used. These have the same inside dimensions as the single-walled hive, and are generally made to take the same supers and the same inside furniture. The first double-walled hives that we used were two-story; but they were awkward and unwieldy things compared with the hives of to-day. The one shown in the illustration next following represents a ten-frame Langstroth single-story double-walled hive; and as it represents the simplest form of wintering hive, we will describe this only, leaving the reader to adapt it to the dimensions of whatever frame he is using.



Buckeye double-walled hive with space between the walls filled with packing material.

The space between the walls is filled with some porous material like dry leaves, planer shavings, cut straw or hay, ground cork, or any material that is light, loose, and porous. An examination of the following illustrations will show how this warm ideal hive differs from the others.

Bees are essentially warm-blooded animals, and if they are not warmly housed in our northern climates they will die dur-

ing winter. If you consult some of the old farmers or your grandfather and ask him why he gave up his bees, he will probably tell you because they died off during winter. The hive that we are here recommending, if the winter is not extremely severe, will winter 95 per cent of the colonies, while the ordinary box hive of our grandfathers' day or the more modern single-walled hive may lose anywhere from 40 to 75 per cent.

But perhaps you have heard how some beekeepers who have their bees in single-walled hives put them in cellars; keep them there during the winter, and then take them out during spring. Yes, there are experts who do this successfully, but where there is one that succeeds by that method there are hundreds who fail. Even if one is an expert he may not have a cellar where he can control the temperature so necessary to maintain the life of the bees during the changeable weather outside; a poor cellar is worse than nothing.

Careful observations have shown that these double-walled packed hives will yield larger returns in honey. For it is a well-known fact in the domestic economy of a hive that comb building can not progress unless a temperature of 98 degrees is maintained, night and day. Frequently in good honey-gathering weather the nights are cold enough so that the inside of the hive will be chilled, and comb building will stop; for the bees are compelled to leave that work to hover around their brood to keep it warm. In doing this they consume largely of their stores in order to keep up the necessary hive temperature. In the double-walled packed hive brood rearing and comb building can continue, no matter what the temperature during ordinary summer weather may be outside.

But this is not all. While bees in single-walled hives often do come through the winter successfully, the result is attained at a considerable loss in stores. Overfeeding on the part of the bees in order to keep up the temperature of the cluster, causes overloading of the intestines, and this sooner or later brings on the fatal disease known as dysentery. Nothing will use up a colony's vitality in the spring more than this dread disease. On the other hand, bees in double-walled packed hives will rarely have the malady. The result is they come through stronger, cleaner, and better, with a larger stock of stores in reserve to take care of the necessary brood rearing that takes place as soon as warm weather opens up.

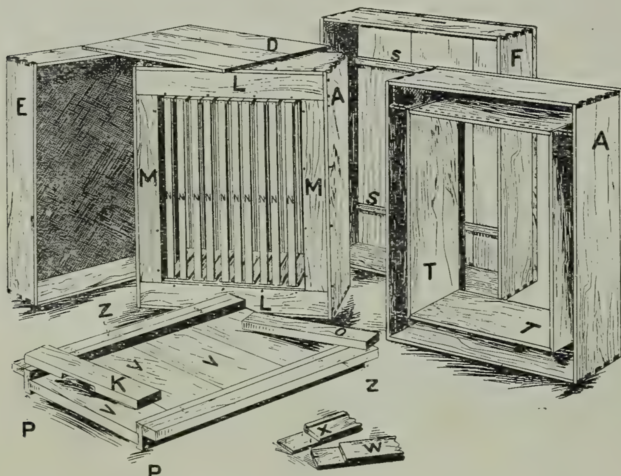
The reason for this is plain: Experiments show that the internal temperature of a single-walled hive outdoors during winter is only slightly higher than that outdoors. On the other hand, the internal temperature of a double-walled packed hive is anywhere from 25 to 50 degrees higher than the outside temperature. (See *Gleanings in Bee Culture*, page 78, for 1912.) The colder the atmosphere in which the bees are kept the more they have to eat. Overfeeding plus cold causes dysentery.

Taking everything in consideration, if the double-walled hives cost more than the single-walled, they will save from 25 to 50 per cent of the stores, and anywhere from 50 to 90 per cent of the winter losses, year in and year out. During spring and summer a larger return in honey may be expected for the reason the bees are not obliged to stop their comb-building because their super is too cold nor stop brood-rearing in the spring. Neither are they forced to eat too much of the freshly gathered stores in order to keep up bodily heat.

But perhaps one might say that it would be cheaper to buy single-walled hives; get some old drygoods boxes; gather a lot of dry leaves, set the hives in the boxes and pack them up for winter. Yes, some do this, but it entails a large amount of time and labor; but, worst of all, it is difficult to keep the packing material around the hives in these store boxes dry. If they once become wet and then freeze, the poor bees are practically in blocks of ice. On the other hand, a warm, well-fitted double-walled factory-made hive, moisture and water tight, keeps the bees warm and dry.

Let us glance for a moment at the illustration of this hive. First we start with the bottom board or floor; this is made of single thickness of pine lumber. It is not necessary to have this double, since it has no exposure like the sides and top. The brood chamber is made up of an outer or inner rim of select $\frac{3}{8}$ lumber, lock cornered together for strength. The space between the two walls is covered

over with a sort of picture-frame water-table. This is secured to the inner chamber in the manner shown; cleats I I as well as the water-table are then nailed to the inner and outer chamber. The two chambers are turned upside down before the bottom cleats are nailed in and then filled with packing material.



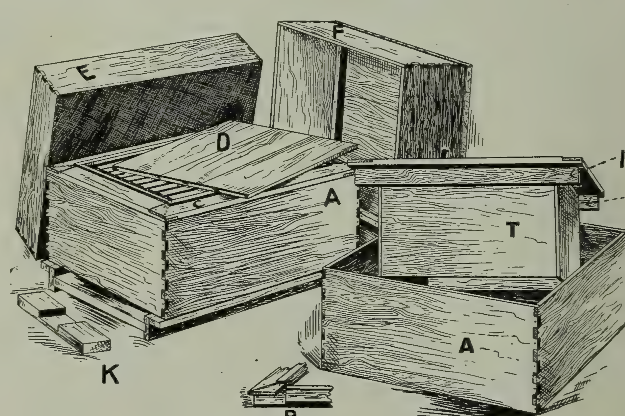
Buckeye hive dissected, showing separate parts, and how the brood-chamber packing is shut in by cleats M and L. A, Outer wall brood-chamber; T, Inner wall brood-chamber; X, W, Packing space cover; L, M, Packing space bottom; F, Telescopic cover; E, Chaff tray; D, Super cover.

Experience shows that the top needs protection more than the sides. Hence we have tray E made of ⅜-inch lumber with a bottom of common burlap. Cover D is put in place after the frames and the bees are in the hive, then tray E is put on top of the whole. This is filled level full of packing material, such as leaves or planer shavings, and over this then is placed the large cap or cover that goes over the whole.

It will thus be observed that we have something on the style and lines of an ordinary refrigerator, or an ordinary safe that sometimes has to go through a fire. Anything that will keep ice from melting will in like manner keep water from freezing. The principle is the same as the thermos bottle, so well known on the market. The thermos bottle will keep water cold or hot for hours and hours. The double-walled hive here shown will keep a cake of ice, if the entrance is closed, almost as well as a refrigerator. It will also hold a pail of boiling water and keep it hot for hours on the principle of a fireless stove.

The general features that go to make up a refrigerator or a safe apply equally well to a beehive.

There are some double-walled hives on the market that can be bought for less. From the very nature of their construction they can not very well be packed. Some have the idea that a hive having so-called dead-air space will winter bees as well as one having space filled with packing material. No greater mistake could be made. In the first place, there is no such thing as "dead air" space in a beehive or in anything else. Air is bound to circulate. The air next to the outer wall that is cold cools and necessarily circulates over to the other side or inner side where it is warm. The cold air rushing over to the warm side cools the warm side, thus making the inner wall almost as cold as the outer. When a hive is so designed that it can hold packing material, this material holds an infinite number of pockets of air in little compartments. As the air in



Buckeye hive dissected, showing the inner walls detached from the outer walls of the brood-chamber.

these compartments can not circulate, it follows that the outer wall may be comparatively cold, while the inner one will be warm. The fact that all refrigerators have the space between the walls packed with material, goes to show that the theory of

"dead air" space between two walls is all wrong. Not only that, but actual practice shows a big difference between the so-called double-walled dead-air-space hive and a real double-walled hive, the spaces between which are packed. It costs more to make a hive that will hold packed material, and that is a reason why such hives cost more than some of the so-called double-walled hives on the market.

We would call attention also to the fact that this hive has a loose bottom and loose cleats, front and rear. In the spring of the year refuse and propolis will accumulate on the bottom board. All that is necessary is to lift the hive body off the bottom, loosen front and rear cleats K and O, scrape off and clean the dirt, replace the cleats and put the hive back on its bottom.

But the question may be asked why Cleats K and O are loose. During hot weather it is recommended that cleat K should be removed entirely. If the colony is very strong, remove cleat O also, and this makes a draft of air between front and rear of the hive.

The question may be raised: If such ventilation is needed, why is it necessary to have the hive so warm with double walls? For the simple reason that the upper part of the hive should be kept warm while the bottom should be cool. If the weather changes suddenly at night, or if it turns cold or chilly as it often does during midsummer, the double walls and the packing keep the colonies warm and conserve the brood and the honey when otherwise some of the brood might be chilled and the stores consumed.

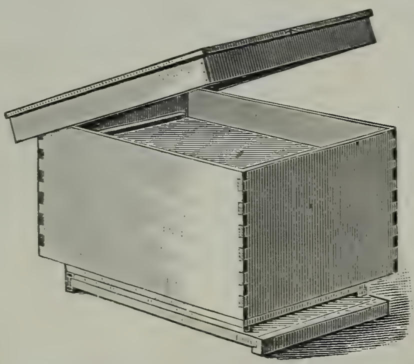
Every now and then beginners will write us, asking what was the matter with their brood and inquiring whether the disease known as foul brood has got into their hives. While it is possible for bees to have disease, it very often happens that the brood is chilled because the small cluster in a single-walled hive is not able to keep the brood warm.

PACKING MATERIAL.

We formerly used wheat or oat chaff; but as we could not secure this readily we gradually began to use planer-shavings, which we can get more easily. These, we find, answer every purpose, and we now use them exclusively. Forest leaves, if dry, will do just as well, and they have the advantage that they make the hive, when packed, lighter—that is, easier to lift and handle.

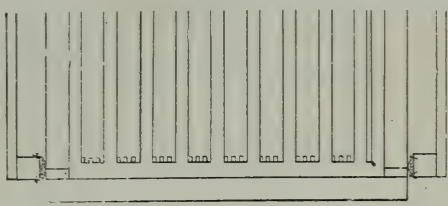
WINTER CASES.

There are a great many who, having in use a large number of single-walled hives, prefer to winter on their summer



Outside winter cases.

stands, if that can be done. For such there has been devised a winter-case made of $\frac{3}{8}$-inch lumber, and just enough larger than the hive to be protected to give one or two inches of packing-space all around the hive. This is placed over and around the smaller hive, the space at the bottom edges between it and the inner hive being closed



up with $\frac{7}{8}$-inch cleats padded so as to fit the hive closely, as shown in the diagram. Packing material is then poured in and around the hive and on top, when the telescope cover is placed over the whole.

Colonies in such packing-cases winter well. But when it comes to unpacking in spring, they are very inconvenient, to say the least. The packing material has to be scooped out and poured into baskets, when the cover is removed to see if the bees are alive. The loose stuff tumbles down between the frames, much to the annoyance of the apiarist and discomfort of the bees. For that reason we greatly prefer the regular double-walled hive pure and simple.

If the locality is cold enough to warrant wintering in the cellar, we should, of course, use single-walled hives exclusively.

HIVES, EVOLUTION OF. Primitive hives were simply the trunks of trees in which bees were lodged, cut down, and carried wherever the beekeeper desired. This plan of beekeeping is still practiced in some parts of Europe, and is common enough in Africa. The stingless-bee apiaries of South America have hives of this description.

The next step was to construct a cylinder resembling the trunk of a tree, either of wood or earthenware. In northern climates straw came into use, but had to be fashioned in the shape of a bell to make it easy of construction. This is the kind of hive which was so highly praised by poets. It has the merits of extreme simplicity and cheapness. Usually it had cross-sticks added inside to keep the combs from falling down on critical occasions. See SKEPS.

Not all beekeepers were satisfied with these hives; and as early as the 17th century some few began to cast about for something better. Della Rocca, who wrote a book on bees in the 18th century, mentions bar hives as in vogue in the islands of the Grecian Archipelago, where he lived for many years.* Such hives were known even to the ancient Greeks. They resembled large flower-pots with wooden bars on which the bees were to fasten their combs. The shape of the hive made it practically impossible to cause a breakdown of the combs except by heat.

The plan of a movable roof was another step in advance, as it gave the beekeeper an opportunity to put on a super to hold the surplus honey where it should be, and remove the same at the end of the honey harvest.

Mewe, in Great Britain, constructed hives of wood on somewhat the same plan as early as 1652, and these were gradually improved by various inventors.

Maraldi, about the same era as Mewe, invented a single-comb observation hive made with glass sides, which contained the germ of the movable-comb frame. He allowed too much space for one comb, and frequently the bees built their comb crosswise. Still there was in the Maraldi hive the important advantage of handling one comb at a time, and by this means to get a far better conception of what was going on inside the hive. Huber extended this idea by his improvement, Fig. 1, which came very near to the hanging movable frame invented by Langstroth sixty years later.

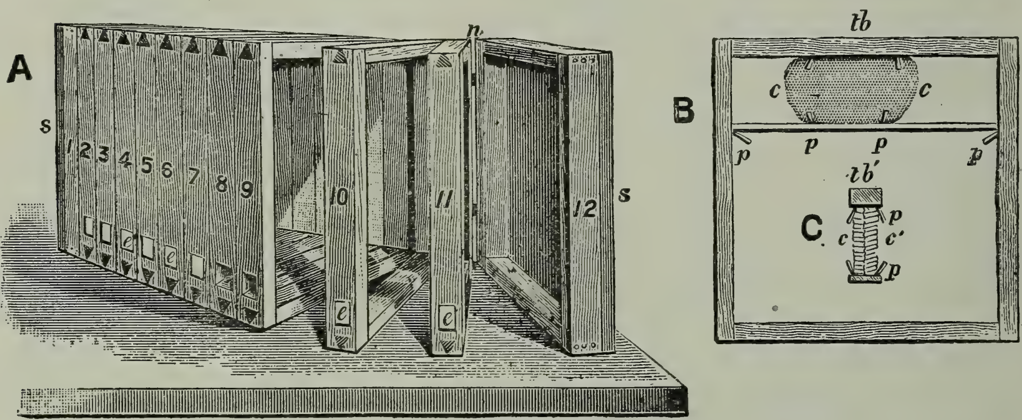


Fig. 2.—Huber's leaf hive, 1789.—*From Cheshire.*

To Huber belongs the credit of inventing hives with movable frames*, and it was by the use of these that he was able to make the discoveries in apiculture which so astonished and delighted the scientific world (see Fig. 2). Huber invented these hives about 1789, or perhaps a little earlier.

* Bar hives and movable combs are referred to in a book published in Italian in 1590. The author was Giovanni Rucellai.—A. C. M.

* This honor is usually ascribed to Langstroth, for, indeed, he was the first one to invent an all-round practical hive and frame—a frame that provided a bee-space all around it; but, strictly speaking, he did not invent the first movable frame.

It has been contended by some writers that Huber's hive was not practical; but some of the most practical beekeepers the world has yet produced used modified Huber hives, notably Quinby and Hetherington,

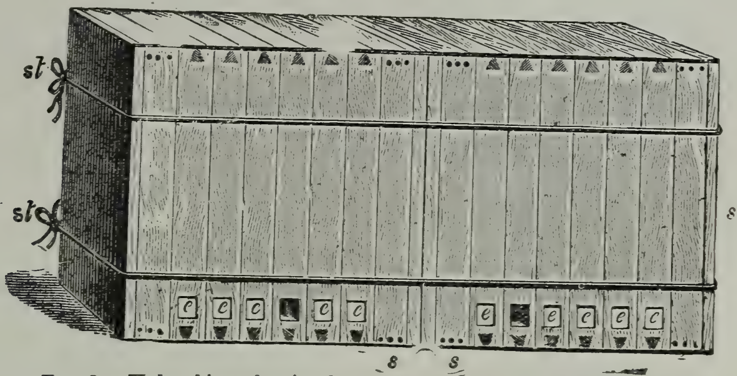


FIG. 3.—Huber hive, showing how he artificially increased the number of his colonies. E, E, E, are entrance holes.—*From Cheshire.*

beekeepers of New York State, whose names are revered by American beekeepers.

Examining the illustrations of Huber's hive makes it evident that he had a clear idea of what was required in a hive for practical purposes. Fig. 3 shows how he increased his apiary by artificial means. In this case he divided a strong colony by slipping a board between the frames, thereby splitting it in two. His plan of pro-

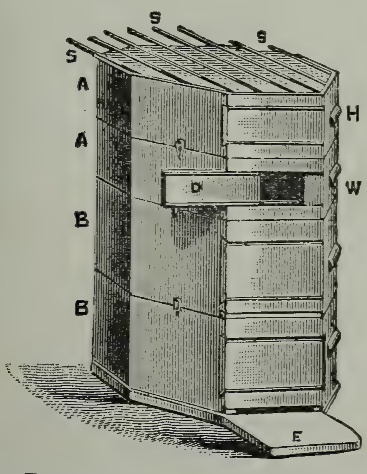


FIG. 4.—The Stewarton hive, 1819; shallow-bar hive with glass strips between bars.—From Cheshire.

viding a part of each frame for surplus honey is excellent. It is very evident from this that Huber invented some of the principal features of our movable-comb hives. The Heddon and Bingham hives are on the Huber plan.

About 1819 Mr. Robert Kerr, of Stewarton, Scotland, invented a bar hive of considerable merit, shown in Fig. 4. This hive was used very successfully, and is still, but with movable frames instead of mere bars. It was still further improved by Howatson, also of Scotland, about 1825. Here we have the tiering principle clearly comprehended; and had this author and

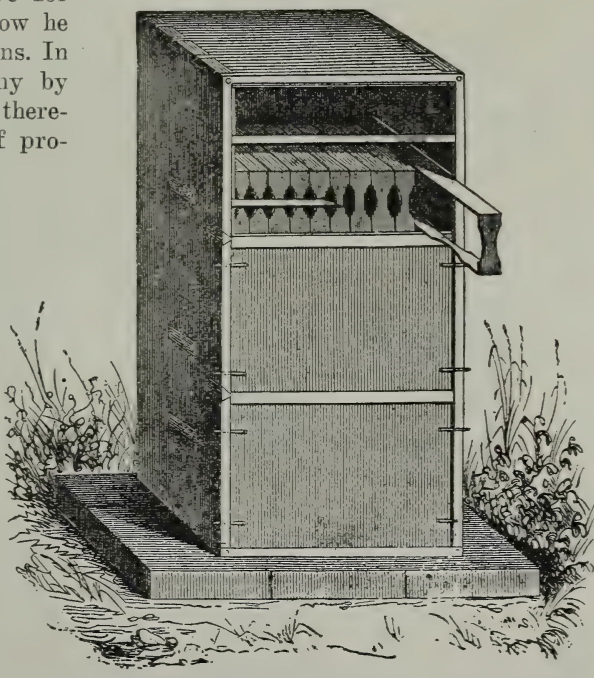


FIG. 5.—Prokopovitsch's hive, 1830.—From Framiere.

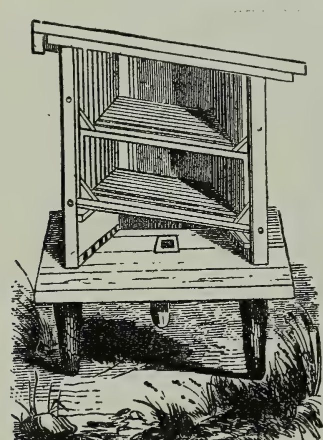
inventor grasped the idea of movable-comb frames instead of bars he would have solved the great problem of inventing a practical hive equal to all emergencies.

Prokopovitsch, a Russian, about 1830, invented and made in large numbers a mov-

able-comb hive of great merit, Fig. 5. In his own apiaries, of which he had many, were over 3000 of these hives in actual use. His pupils (for he established a school of beekeeping) had many more in use. One of the features of this hive was the bee-space, provided by thin bars of wood on the back, sides, and ends of the hive-box.

It may be noted that his surplus frames bear considerable resemblance to our bee-way sections, and that his hives were dovetailed. Prokopovitsch was certainly a beekeeper of remarkable abilities, and employed means and methods far ahead of his time.

It has been claimed by some writers that Dzierzon, of Germany, invented movable frames in 1845; but it is evident he has no claim whatever to this distinction. As a matter of fact, according to his own statements he used bars until 1855, when he was persuaded by Baron Berlepsch to use movable frames, which had just been introduced from America. Dzierzon's bar combs were removed by using a long knife



Debeauvoy's hive, 1845; invented in France before Langstroth's hive appeared.

to cut the attachments from the back of the hive one by one; for, to reach the comb at the front of the hive, all the other combs had first to be removed. His hive was far inferior to those we have already mentioned. When he adopted frames he did not change the construction of his hives in the least.

Next came Langstroth with his epoch-making movable-comb hive with movable roof, which combined the essential requirements of a hive. All the combs in the Langstroth hive are readily removable without the slightest annoyance either to the beekeeper or the bees. Langstroth did his work so well that he left very little for future inventors to do. Many have tried to improve his hive, but in most cases the so-called improvement has proven to be a backward step. The striking feature of the Langstroth hive is the provision for a bee-space on all sides of the comb. This bee-space can not be less than one-sixth of an inch nor more than one-third. This alone was a great discovery, and placed Langstroth far above the mere inventor.

From his writings it is evident that Langstroth knew nothing about what others had done before him in this line; and it is apparent that his invention was the result of a very profound study of the bee and its habits. To some extent he was misled by others into thinking that the principle of the Langstroth hive had been discovered by Dr. Dzierzon independently, whereas there is no manner of doubt that the German beekeeper had no claim to the invention of the hanging movable comb, to say nothing of the bee-space and the movable roof, which are essential features of the hive.

Langstroth's invention, accompanied by an excellent treatise on the art of keeping bees, created a revolution in beekeeping in a short time, linking his name with that of Huber as the two founders of modern apiculture.

HIVES, MANIPULATING. See Frames, to Manipulate.

HIVE-STANDS. See Apiary.

HOLLY. See Gallberry.

HOLY-LAND BEES. See Italians.

HONEY. Every reader of a work of this kind is supposed to know, of course, what honey is; and yet there may be a good many who have only a superficial idea of it, and perhaps a very brief statement should be made.

According to the Century Dictionary, "Honey is a sweet viscid fluid collected from the nectaries of flowers, and elaborated for food by several kinds of insects, especially by the honey-bee (*Apis mellifica.*)" An accepted German definition is, "Honey is the nectar obtained from flowers by

worker bees, which, after modification in the honey-stomach of the latter, is stored in the cells of the comb for the nourishment of the young brood." In this country the food standards consider "honey as the nectar and saccharine exudations of plants gathered, modified, and stored in the comb by honey-bees (*Apis mellifica* and *Apis dorsata*)." In the latter definition there is included, besides the nectar of flowers, also saccharine exudations of plants. This comes about in that many plants contain sugar in their saps, and, when an exudation of sap takes place, and the water in the sap is evaporated, a saccharine residue remains, which is gathered by the bees. Also, many trees exude a sweet sap when stung by some insect, and this is also gathered by the bees. See HONEY-DEW.

Honey in itself is approximately a pure saccharine substance, naturally flavored, and containing aromas imparted to it by the flower and the bee. Its chemical composition shows it to contain, for the greater part, two sugars, dextrose and levulose, in about equal quantities, also generally (but not always) sucrose. The other substances, in order of their quantity, are dextrins, acids, ash, and a number of substances whose nature and composition have not been thoroughly worked out. An average analysis of American honey given by Brown in Bulletin 110, Bureau of Chemistry, United States Department of Agriculture, shows—

Moisture	17.70 per cent
Levulose	40.50 per cent
Dextrose	34.02 per cent
Sucrose	1.90 per cent
Ash	0.18 per cent
Dextrin	1.51 per cent
Undetermined	4.19 per cent
Total	100.00 per cent

Under the national pure-food law, "A honey should be lævorotatory, and should contain not more than twenty-five per cent of water, not more than twenty-five hundredths per cent of ash, and not more than eight per cent of sucrose." All floral honeys are lævorotatory—that is, turn the plane of polarized light to the left, while honey-dew is dextro-rotatory—that is, turns the plane of polarized light to the right. In mixtures of floral honey and honey-dew, honey which bees often collect together, the polarization is about the only means of determining whether the product deserves the name of pure honey.

For the further consideration of this subject see CANDIED HONEY, EXTRACTED HONEY, HONEY-DEW, HONEY AS FOOD, and NECTAR.

HONEY AND ITS COLORS.—The various kinds of honey differ very much in color, flavor, and density. One variety may be practically colorless, while another produced in the same locality, under the same conditions, by the same bees, but from different flowers, may be a dark brown. One kind may contain less than one-sixth of water, while another may contain a third. The proportions of dextrose, levulose, and sucrose vary considerably; but as the extent of the variation is known to chemists they are compelled to take this into account and analyze it differently from the way they would other foods.

Ordinarily honey is judged by its color, flavor, and density. There is an almost endless variety of flavors, making it practicable to suit the most exacting connoisseur. Color is a fair guide, but not always so, for the famous heather honey of Europe is quite dark, and yet no honey stands higher in popular esteem on that continent.

The best honeys of this country are usually spoken of as "water-white," and, though this is not quite correct, still it is near enough for all practical purposes without coining a new word.

Clover honey may be taken as the typical white honey by which others may be conveniently judged. For the purpose of comparison some may be a little lighter, and others a little darker shade; but these nice points of distinction are visible only to an expert.

Taken by this standard, in the North we have all the clovers—white, alfalfa, crimson, mammoth, alsike, sweet—and the European sainfoin, basswood, raspberry (wild), willow-herb (or fireweed), Canada thistle, apple, cucumber (pickle), and Rocky Mountain bee-plant. In the South we have white honey from the following: Gallberry (holly), sourwood, tupelo, mangrove, cotton, palmetto, huajilla, catclaw, huisache, mesquite, California sage, and some others of less importance. From the American tropics the chief white honeys are logwood, or campeche; campanilla (Cuba), and the

mangrove (courida), on all tropical seashores.

Amber-colored honey comes from many sources. Among them, only the more familiar ones can be noted in a popular book of this kind; namely, goldenrod, wild sunflower, heartsease, Spanish needle, sumac, milkweed, poplar, gum, magnolia, lima bean, marigold, horsemint, horehound, carpet-grass, and the hog plum (hobo), rose-apple, and royal palm of the West Indies.

Of dark honeys we take two great examples—the buckwheat of the United States and Europe, and heather, which is confined to Europe alone. The latter, though dark, is a rich, strong-flavored, thick honey, so dense that the extractor is not used to take it from the combs. That produced in Scotland commands a very high price, while that of England is cheaper, being gathered from another species of heather. In North Germany the heath or heather honey commands a good figure. It is largely produced by migratory beekeepers, their bees existing on white clover during summer, and in the fall being moved to the heaths.

Buckwheat honey is not nearly as good as clover, either in flavor, density, or color; but it is so liberally produced in buckwheat localities that it is a paying crop to the beekeeper. It blooms late, hence the bees can be prepared in ample time to profit by its bloom. This feature alone makes it very valuable to the beekeeper who is fortunate enough to live in a buckwheat-growing section. In those parts of this country where buckwheat is grown largely, consumers are willing to pay as much, or almost as much, as they will for fine white honey. Indeed, many prize it more highly.

In France there is a great demand for buckwheat honey from bakers of a kind of bread which has been made for centuries. No other sort of honey is desired by these bakers, who derive nearly all their supply from Brittany, where buckwheat is commonly sown. Attempts have been made to get the bakers to use other dark honeys, but without success.

In Europe there are some prominent honeys which are almost or quite unknown in this country. Heather has been mentioned. Sainfoin is another which is quite common, being almost the same as alfalfa honey with us. Narbonne honey belongs to this class. In southern Europe romarin (rosemary) is very highly spoken of; and in Greece there is the classically famous honey of Mount Hymettus, from wild thyme. In Australia the honey of eucalyptus is highly appreciated, but attempts to sell it in England have always ended in failure, although it ought to be useful for persons suffering from coughs and colds. Instead of the eucalyptus flavor proving to be an attraction it proved a drawback. In California, eucalyptus honey has a limited demand.

HONEY AS A FOOD.—Nearly eighty pounds of sugar on the average is annually consumed by every man, woman, and child in the United States. It is only within the last few centuries that sugar has become so low in price as to come into general use even among the poorest families. Formerly, honey was the principal sweet, and it was one of the items sent as a propitiatory offering by Jacob to his unrecognized son, the chief ruler of Egypt, 3000 years before the first sugar-refinery was built.

The health of the present generation would be greatly benefited if honey could be at least partially restored to its former place as a common article of diet. The almost universal craving for sweets of some kind shows that the system demands food of this kind, but the excessive use of sugar brings in its train a long list of ills. Prof. A. J. Cook, of Claremont, Cal., says, "If cane sugar is absorbed without change, it will be removed by the kidneys and may result in their breakdown. * * * There can be no doubt but that in eating honey our digestive machinery is saved work that it would have to perform if we ate cane sugar. * * * We all know how children long for candy. This longing voices a need and is another evidence of the necessity of sugar in our diet. * * * Children should be given all the honey at each meal time that they will eat. It is safer and will largely do away with the inordinate longing for candy and other sweets, and in lessening the desire will doubtless diminish the amount of cane sugar eaten." Dr. Nuttall, a physician of the Pacific Medical Institute, Los Angeles, Cal., has

stated that honey is a most valuable food, and that he is recommending it to patients suffering from impaired digestion.

Dr. Talmadge, of Salt Lake City, Utah, is using honey very successfully in the treatment of typhoid-fever patients, and he finds that it is readily absorbed even by those whose digestion is very weak. Dr. J. H. Kellogg, Battle Creek, Mich., endorses honey as the best form of sweet. In fact, all doctors and physicians who have made a study of honey as compared to sugars or syrups, strongly recommend its use.

WHY USE HONEY IN COOKING.

There are a number of reasons why honey may often be profitably substituted for sugar or cheap molasses in cooking. In the first place, as has already been pointed out, honey is vastly more healthful than sugar and especially than cheap molasses. In the second place, baked goods and, in fact, foods of any kind prepared with honey, keep better than if prepared with sugar. One of the properties of honey is that it absorbs moisture from the air. Cookies and cakes, on this account, are much less likely to dry out if honey is used for sweetening. Furthermore, as is well known by scientists, honey, in a sense, is a preservative. Fruit put up with honey not only keeps better, but the color is brighter, and cakes and cookies are less likely to grow musty. Madame Maurice Maeterlinck, wife of the celebrated Belgian writer, uses honey in preparing many different kinds of food, such as baked apples, oatmeal bread, gingerbread, etc. She also believes that fruits preserved with honey are "like new conserves."

It would doubtless astonish the average person to know the immense quantities of honey used annually by the large baking concerns. The National Biscuit Company alone has purchased in one lot seventy carloads of fine honey, and they are always in the market for good honey in large quantities.

We have no desire to recommend an article that is cheap. Compared with some of the compounds on the market called syrup, honey may be considered somewhat expensive. However, if the simple experiment be tried of comparing the sweetening power of corn syrup, for instance, with honey, it will be found that if a recipe calls for one cup of honey, two or three cupfuls of corn syrup will be needed or else a correspondingly larger amount of sugar. Viewed from this light, honey is not expensive after all.

The best grade of New Orleans molasses sells for about 18c a can. The cans average $2\frac{1}{2}$ pounds, so the price of the molasses per pound is a little over 7c. Since the darker, less expensive grades of honey may usually be bought for almost as low a figure, the quality of the cake or cooky is thus improved both from the standpoint of healthfulness and flavor at practically no increase in cost. In fact, there can be no comparison between honey and New Orleans molasses, for honey is a distinctly different and better article.

At the present time, sugar is selling in a retail way for 8c per pound, but this we admit is above the average price. However, sugar rarely is lower than $5\frac{1}{2}$c per pound retail, and when it is considered that the excessive use of sugar not only injures the teeth but impairs the digestion, it can be seen that honey must not be considered by any means a luxury, but as a real necessity in the home.

THE HONEY RECIPES.

All of the recipes here given have been thoroughly tested; but any recipe, while it may be successful in the hands of the originator, often needs modification when it is tried by others. We believe all the recipes in this book will give good results, but there are a few which are especially fine. In this connection, we wish to call particular attention to the one for making cereal coffee. The ingredients used are so simple and the work of preparing consumes so little time that there is no one who should miss trying this delightful drink. It has a very rich flavor, especially when cream is used, without the scorched, bitter taste that most cereal coffees have. The expense, of course, is so little as to be practically nothing. The honey and egg used allow the bran to brown to a rich color without burning, so that the final result is surprising. Try it.

CAUTION REGARDING THE USE OF HONEY IN COOKING.

The indiscriminate substitution of honey for sugar in ordinary cooking recipes is

not to be recommended, for the physical properties of honey are quite different from those of sugar, so that usually an entirely different recipe must be used. The mere substitution of honey for sugar in most instances would result in a heavy cake that would be pronounced by most cooks a failure.

In this connection it may be well to mention that, when baking with sour milk and soda, it is a good plan to add a pinch of baking powder to every pint of flour. Cakes will be lighter and finer grained if this is done.

HONEY CAKES.

Lemon Cakes.—Bring 1½ cupfuls of honey to a boiling-point. Skim if necessary. Add ¼ cupful of butter and cool. Add 2 cupfuls of pastry flour, stirring it in carefully. Let this mixture stand over night. When ready to bake, stir in the grated yellow rind of 1 lemon, 2 tablespoonfuls of lemon juice, ½ cupful of chopped blanched almonds; add ½ teaspoonful of soda dissolved in a little lukewarm water, and bake in small round tins. Ice when cool.

Nut Cakes.—Beat to a cream ½ cupful of butter and 1 cupful of powdered sugar. Beat into this 1 egg well beaten and ½ cupful of honey. Stir in 2 cupfuls of pastry flour, previously sifted with 2 teaspoonfuls of baking powder, and last stir in ½ cupful of finely chopped filberts. Let the mixture stand where it is very cold (do not freeze) over night. When ready to bake, roll the dough very thin, cut into fancy shapes, brush them over with the white of an egg diluted with a teaspoonful of warm water. Sprinkle the cakes with granulated sugar and chopped filberts. Bake in a hot oven until a golden brown.

Short Cake.—Three cups flour, 2 teaspoonfuls baking powder, 1 teaspoonful salt, ½ cup shortening, 1½ cups sweet milk. Roll quickly, and bake in a hot oven. When done, split the cake and spread the lower half thinly with butter, and the upper half with ½ pound of the best-flavored honey. (Candied honey is preferred. If too hard to spread well it should be slightly warmed or creamed with a knife.) Let it stand a few minutes, and the honey will melt gradually, and the flavor will permeate all through the cake. To be eaten with milk.

Sour-milk Cake.—¼ cup lard or butter, ½ cup sugar with a little salt mixed in; beat the sugar and lard to a cream, then add ½ cup of honey, ½ cup sour milk, 1 egg, 1 2-3 cups flour, ½ teaspoonful soda in flour; also 1 small teaspoonful baking powder; ½ teaspoonful cinnamon, ¼ teaspoonful cloves, a little nutmeg. Bake either in jelly-tins or loaf and put it together with caramel frosting.

Nut Cakes.—Eight cups sugar, 2 cups honey, 4 cups milk or water, 1 lb. almonds, 1 lb. English walnuts, 3 cents' worth each of candied lemon and orange peel, 5 cents' worth citron (the last three cut fine), 2 large tablespoonfuls soda, 2 teaspoonfuls cinnamon, 2 teaspoonfuls ground cloves. Put the milk, sugar, and honey on the stove, to boil 15 minutes; skim off the scum, and take from the stove. Put in the nuts, spices, and candied fruit. Stir in as much flour as can be done with a spoon. Set away to cool, then mix in the soda (don't make the dough too stiff). Cover up and let stand over night, then work in flour enough to make a stiff dough. Bake when you get ready. It is well to let it stand a few days, as it will not stick so badly. Roll out a little thicker than a common cooky. Cut in any shape you like.

This recipe originated in Germany, is old and tried, and the cake will keep a year or more.

Hard Cake.—Take 6 lbs. flour, 3 lbs. honey, 1½ lbs. sugar, 1½ lbs. butter, 6 eggs, ¼ oz. saleratus; ginger to your taste. Directions for mixing: Have the flour in a pan or tray. Pack a cavity in the center. Beat the honey and yolks of eggs together well. Beat the butter and sugar to cream, and put into the cavity in the flour; then add the honey and yolks of the eggs. Mix well with the hand, adding a little at a time, during the mixing, the ½ oz. saleratus dissolved in boiling water until it is all in. Add the ginger, and finally add the whites of the 6 eggs, well beaten. Mix well with the hand to a smooth dough. Divide the dough into seven equal parts, and roll out like gingerbread. Bake in ordinary square pans made for pies, from 10x14 tin. After putting into the pans, mark off the top in ½-inch strips with something sharp. Bake an hour in a moderate oven. Be careful not to burn, but bake well. Dissolve sugar to glaze over top of cake. To keep the cake, stand on end in an oak tub, tin can, or stone crock—crock is best. Stand the cakes up so the flat sides will not touch each other. Cover tight. Keep in a cool dry place. Don't use until three months old at least. The cake improves with age, and will keep good as long as you will let it. I find any cake sweetened with honey does not dry out like sugar or molasses cake, and age improves or develops the honey flavor.

Soft Cake.—One cup butter, 2 cups honey, 2 eggs, 1 cup sour milk, 2 teaspoonfuls soda, 1 teaspoonful ginger, 1 teaspoonful cinnamon, 4 cups flour.

Eggless Cake.—One cupful sugar, ½ cup honey, 1 cupful sour milk, 2 tablespoonfuls of butter, 1 cupful chopped raisins, 1 cupful chopped dates, 1 teaspoonful soda, 2½ cupfuls flour. Spices may be added to taste.

Sponge Cake.—One coffee-cup honey, 1 cup flour, 5 eggs. Beat yolks and honey together. Beat whites to a froth. Mix all together, stirring as little as possible. Flavor with lemon juice or extract.

"Railroad" Cake.—One cup honey, 1 heaping cup flour, 1 teaspoonful cream tartar, ½ teaspoonful soda, 3 eggs, and a little lemon juice. Stir all together ten minutes. Bake 20 minutes in quick oven.

Lemon Cakes.—One cup butter, 2 cups honey, 3 eggs well beaten, 1 tablespoonful essence lemon, ½ cup sour milk, 1 teaspoonful soda. Flour enough to make as stiff as can well be stirred. Bake at once in quick oven.

Jelly Roll.—Yolks of 6 eggs or 3 eggs, 1 cup of white sugar (scooped), 1 cup of flour (heaped), 1 teaspoonful of butter, 2 tablespoonfuls of sweet milk, 2 teaspoonfuls of cream tartar, 1 teaspoonful soda or 2 of baking powder. Bake in an oblong pan, spread with granulated honey, and roll at once. Set where it will cool quickly.

Swiss Cake.—Melt 4 ounces butter; add 1 lb. of honey, stirring well; take it off the fire and let it cool. Add the minced rind of a large lemon, 4 ounces sweet almonds chopped fine, a little nutmeg, 2 scant teaspoonfuls of carbonate of soda, dissolved in a little water. Mix these well and add flour until very stiff, and set in a cool place 12 hours. Roll out ½ inch thick, cut into squares,

decorate with nuts and chopped citron. Bake in hot oven. Make two dozen cakes from this amount.

Pork Cake.—One pound fat pork chopped fine, 1 pint boiling water poured on pork; 2 cups honey, 3 teaspoonfuls soda, 2 cups raisins, 2 teaspoonfuls each of cloves, cinnamon, and nutmeg; about 7 cupfuls of flour.

Coffee Cake.—1 cup of honey, ½ cup of sugar, shortening size of an egg, 3 cups flour, 1 teaspoonful soda dissolved in 2-3 cup of cold coffee (scant), 1 teaspoonful of cinnamon, ½ teaspoonful of cloves, ½ teaspoonful of nutmeg, 1 cup of raisins (floured). If too thin, add a little more flour.

Fruit Cake.—Two cups of honey, 2 cups of raisins, 1 cup of shortening, ½ cup of sour milk, 1 teaspoonful soda, ½ teaspoonful cloves, ½ teaspoonful cinnamon, ½ teaspoonful nutmeg, 4 cups flour. Bake 40 minutes.

Fruit Cake.—One and one half cups honey, 2-3 cup butter, ½ cup sweet milk, 2 eggs well beaten, 3 cups flour, 2 teaspoonfuls baking powder, 2 cups raisins, 1 teaspoonful each of cloves and cinnamon.

Fruit Cake.—One-half cup butter, ¾ cup honey, 1-3 cup apple jelly or boiled cider, 2 eggs well beaten, 1 teaspoonful soda, 1 teaspoonful each of cinnamon, cloves, and nutmeg; 1 teacupful each of raisins and dried currants. Warm the butter, honey, and apple jelly slightly; add the beaten eggs, then the soda dissolved in a little warm water; add spices and flour enough to make a stiff batter, then stir in the fruit and bake in a slow oven. Keep in a covered jar several weeks before using.

Fruit Cake.—Two eggs well beaten, 1 cup butter, ½ cup sour cream, 1 cup honey, ½ cup sugar, 1 teaspoonful soda dissolved in warm water, 1 teaspoonful cinnamon, ½ teaspoonful cloves, 1 cup raisins, 1 cup currants, 2 cups flour.

Honey Tea-cake.—One cup honey, ½ cup sour cream, 2 eggs, ½ cup butter, 2 cups flour, scant ½ teaspoonful soda, 1 tablespoonful cream of tartar. Bake 30 minutes in a moderate oven.

Fruit Cake.—Four eggs, 5 teacups flour, 2 teacups honey, 1 teacup butter, 1 teacup sweet milk, 3 teaspoonfuls baking powder, 1 lb. raisins, 1 lb. currants, 1 teaspoonful cloves, 1 teaspoonful cinnamon, 1 teaspoonful nutmeg. Then bake in slow oven. The above will keep moist for months.

Citron Cake.—Two eggs, 1 cup dark honey, 4 tablespoonfuls butter, 1 cup milk, 3 cups flour, ¼ lb. citron chopped fine, 2 teaspoonfuls baking powder, 1 teaspoonful lemon.

Raisin Cake.—Three eggs, 1 cup honey, 4 tablespoonfuls melted butter, 1 cup sweet milk, 1 1-3 cups raisins chopped fine, 3 cups flour, ½ teaspoonful salt, ½ teaspoonful soda, 2 teaspoonfuls baking powder, 1 teaspoonful vanilla extract.

Ammonia Cake.—(Pain d'epice, or Leb Kuchen). Use 3 lbs. of honey, 3 lbs. of flour, 1 oz. powdered ammonia, a small teacupful of ground cinnamon, ½ teaspoonful of ground cloves, 6 oz. orange peel (or citron) cut very fine; 4 oz. sweet almonds cut very small. (The ammonia evaporates in baking.) Directions: Pour the honey in a graniteware or copper sauce-pan, and set on the stove. When it boils, draw it aside and remove the scum. (As honey boils and burns very quickly, great care must be used.) Then pour the honey into the vessel in which the paste is to be made; leave it to cool; then add flour and other ingredients, except the ammonia, which latter must not be added till the flour and honey have been mixed up and the paste has become cold. In preparing for use, place the ammonia in a cup; pour on a few drops of cold water and stir it well, so as to form a thick paste, then mix it up with the rest. Then take a piece of the paste, roll it out into a cake not over ¼ inch thick, and cut up into convenient sizes. Put these on a flat tin and bake in a hot oven 12 to 15 minutes. The above is made by the monks of Buckfast Abbey, England.

Drop Cakes.—Two eggs beaten without separating, 3 tablespoonfuls softened butter, 1-3 cup honey, 1 1-3 cups flour, 1 1-3 teaspoonfuls baking powder. Drop on buttered baking-sheet about ½ teaspoonful of batter to a cake. Put them well apart; spread slightly with the bowl of a tin spoon, dipped in cold water; press one pecan nutmeat on the top of each.

Drop Cakes.—One cup honey, ½ cup sugar, ½ cup butter or lard, ½ cup sour milk, 1 egg, ½ teaspoonful soda, 4 cups sifted flour. Flavor to taste.

Choice Drop Cakes.—One gallon honey (dark honey is best), 15 eggs, 3 lbs. sugar (a little more honey in its place may be better); 1½ oz. baking soda, 2 oz. ammonia, 2 lbs. almonds chopped up, 2 lbs. citron, 4 oz. cinnamon, 2 oz. cloves, 2 oz. mace, 18 lbs. flour. Let the honey come almost to a boil; then let it cool off, and add the other ingredients. Cut out and bake. The cakes are to be frosted afterward with sugar and white of eggs.

Drop Cakes.—Take ½ cupful of butter, ½ cupful of sugar, and blend them; after which add 1 cupful of strained honey, the beaten yolks of 2 eggs, 3 tablespoonfuls of lemon juice, and the whites of 2 eggs beaten dry. Mix well, and add 3½ cupfuls of flour and 1 teaspoonful of soda; 1 teaspoon baking powder, a little nutmeg. More flour may be added, if needed, and often is, for the dough should be stiff enough so that it will drop by spoonfuls on to a buttered baking-pan. Shape round, and bake in a moderate oven.

Tea Cakes.—Blend 1-3 cup honey, 1 teaspoonful butter, 1 egg well beaten, 2-3 cup flour, sifted with half a teaspoonful of baking powder, and a pinch of salt. Drop by teaspoonfuls on a tin, and bake in a quick oven. These proportions will make about 20 cakes.

Ginger Cake.—One cup honey, ½ cup butter, or drippings, 1 tablespoonful boiled cider, in ½ cup of hot water (or ½ cup sour milk will do instead). Warm these ingredients together, and then add 1 tablespoonful ginger and 1 teaspoonful soda sifted in with flour enough to make a soft batter. Bake in flat pan.

Gingerbread.—Warm together ½ cup of brown sugar and honey, with 1-3 cup of shortening. Remove from stove; add ¾ cup sour milk and 2 eggs; pour gradually into bowl containing 2 cups of flour sifted with a tablespoonful ginger, a scant teaspoonful soda, and a little salt. Other spices may be added. Bake in moderate oven.

Gingerbread.—One egg, 1 cup honey (dark), 1 cup milk (sour), 2 tablespoonfuls butter, ½ teaspoonful soda, 1 teaspoonful ginger. Flour to make rather stiff batter.

Alsatian Gingerbread.—One pound honey, 1 pound flour; ginger to suit; 2½ drams bicarbonate soda. The honey is first brought to a boil, preferably in a double boiler. It is then removed from the fire, and the flour well stirred into it, and then the soda (or baking powder); bake. If sweet gingerbread is wanted, add the white of an egg, well whipped, and more honey. The above will keep well for a year if kept in a cellar.

Ginger Cake.—Put 1 cup darkest honey into a dish with ½ cup brown sugar; 1 teaspoonful salt, 2-3 teaspoonful vanilla, ¼ teaspoonful ground cloves, ½ teaspoonful cinnamon, ½ teaspoonful ginger. To this add 2 tablespoonfuls soda dissolved in 1 cup boiling water. Stir together well; ½ cup cold water. Nearly 1 cup shortening. Stir in flour until thick as molasses. Break in 1 large egg; beat thoroughly with egg-beater. Pour into two 9-inch jelly-tins and tuck in raisins. Bake in an even, brisk oven.

Ginger Cake.—Three cups flour, ½ cup butter; rub well together. Add one cup brown sugar; 2 large tablespoonfuls ginger; same of caraway seeds if you like; 5 eggs, 2 cups honey, 3 teaspoonfuls baking powder. Beat it well, and bake in an iron pan an hour or more.

Layer-cake.—Two-thirds cup butter, 1 cup honey, 3 eggs beaten, ½ cup milk. Cream the honey and butter together, then add the eggs and milk. Then add 2 cups flour containing 1½ teaspoonfuls baking powder previously stirred in. Then stir in flour to make a stiff batter. Bake in jelly-tins. When the cakes are cold take finely flavored candied honey, and, after creaming it, spread between layers.

HONEY COOKIES.

Aunt Millie's Cookies.—One cup butter beaten light, 1 cup sugar beaten to cream with butter, 1 cup honey. Let honey warm; put 1 teaspoonful of soda in the honey. If you have fermented honey, use that with soda, as it is as good as cream tartar. If you have not the fermented honey, then use 2 teaspoonfuls of cream tartar and 1 teaspoonful of soda, or 2 teaspoonfuls of baking powder. When the honey has cooled, beat light and add to the butter and sugar. Then add 1 cup cold water, 1 teaspoonful vanilla, flour to make a very stiff dough. Fill a salt-shaker with powdered sugar; shake over the sheet of dough after it is rolled; press the sugar by rolling the pin over it once more. Then cut out and bake brown in a moderate oven.

Cream Cookies.—One teacupful extracted honey, 1 pint sour cream, scant teaspoonful soda, flavoring if desired; flour to make a soft dough.

Fowls' Cookies.—Three teaspoonfuls soda dissolved in 2 cups warm honey, 1 cup shortening containing salt, 2 teaspoonfuls ginger, 1 cup hot water; flour sufficient to roll.

Vinegar Cookies.—One cup of butter and lard mixed; 1 cup of sugar, 4 eggs, 2 cups of honey, 3 teaspoonfuls of soda in ½ cup of boiling water; spices to taste; flour to roll out; ½ cup of vinegar.

Hard-time Cookies.—One pint of honey, ½ teacupful of granulated sugar, ¼ pint of melted lard and butter mixed; 1 even teaspoonful soda dissolved in ¼ cup of warm water; ½ teaspoonful of ginger, ½ teaspoonful nutmeg, a little salt. Roll rather thin, and bake quickly.

Swiss Cookies.—Prepare some dough as for the gingerbread, and mix with it 1-3 lb. crushed almonds, orange and lemon juice, and cinnamon; and, if desired, cloves to suit the taste.

Tennessee Cookies.—Melt together 1 cup of honey and 1 cup of lard or butter. When cold, add 1-3 of a cup of sugar, a pinch of salt, a tablespoon of soda and 1 egg. Stir in flour enough to make a stiff dough; roll, and cut into small cakes, and bake on greased tins, in a moderate oven.

German Christmas Cookies.—Warm 1 pint molasses, 1 pint extracted honey, 1 pint brown sugar, 1 tablespoonful each of butter and lard; add 2 tablespoonfuls soda in 1 pint of sour cream; 10 cents' worth mixed and ground candied orange and lemon peel and citron; 1 cup nut-meats, 1 ground nutmeg, 1 tablespoonful ground cinnamon, 1 tablespoonful ground cloves, 1 tablespoonful salt; add flour until dough is stiff as cooky dough, or a little stiffer. Leave until morning; then roll out a little thicker and cut in shape and bake in hot oven. If the dough is too soft to roll in the morning add more flour. Frost with lemon icing made from powdered sugar and water. Pack in stone jars; cover with papers, and tie and put down cellar a month before Christmas.

Sugarless Cookies.—Two cups honey; 1 cup butter, 4 eggs (mix well); 1 cup buttermilk (mix); 1 good quart flour; 1 level teaspoonful soda or saleratus. If it is too thin, stir in a little more flour. If too thin it will fall. It does not want to be as thin as sugar cake. Use very thick honey. Be sure to use the same cup for measure. Be sure to mix the honey, butter, and eggs well together. You can make it richer if you wish by using clabbered cream instead of buttermilk. Bake in a rather slow oven, as it burns very easily. To make the cookies, use a little more flour, so that they will roll out well without sticking to the board. Any kind of flavoring will do.

Ginger Cookies.—One cup honey, ½ cup of sugar, ½ cup shortening, ½ cup warm water, 1 teaspoonful soda, 1 teaspoonful ginger, 5 cups flour, pinch of salt.

Honey-jumbles.—Two quarts flour, 3 tablespoonfuls melted lard, 1 pint honey, ¼ pint molasses, 1½ level tablespoonfuls soda, 1 level teaspoonful salt, ¼ pint water, ½ teaspoonful vanilla.

Ginger Cookies.—Two cups honey, 1 cup sugar, 1 cup lard, 3 eggs, 1 tablespoonful ginger, 1 teaspoonful cinnamon, 2 tablespoonfuls soda, 6 tablespoonfuls vinegar, a pinch of salt; flour enough to roll.

Ginger Cookies.—One cup honey, 1 cup sugar, 1 cup buttermilk, 1 cup lard, 1 teaspoonful salt, 1 teaspoonful cinnamon, 1 teaspoonful ginger, one teaspoonful soda, heaping; 1 teaspoonful lemon extract. Stir stiff with flour; for gingerbread, mix stiff and roll out and cut and bake in quick oven. Also very good with caraway seeds instead of spices.

Ginger-snaps.—One pint honey, ¾ lb. butter, 2 teaspoonfuls ginger. Boil together a few minutes, and when nearly cold put in flour until it is stiff. Roll out thin, and bake quickly.

Dark Cookies.—One cup brown sugar, ½ cup sour cream, 1-3 cup butter, 2-3 cup dark honey, 1 egg, 1 tablespoonful cinnamon, 1 scant teaspoonful soda. Flour to make thick batter. Improved with chopped nuts sprinkled over and pressed in with the bowl of spoon.

German Christmas Cookies.—One quart honey, 1 quart sour cream, 1 tablespoonful ground cloves, 1 tablespoonful ground cinnamon, 1 nutmeg, grated; 4 tablespoonfuls soda, 1 pint of chopped nuts, 5 cents' worth of citron chopped fine; 1 pinch of salt, 1 lb. of brown sugar. Flour to roll. Cut, and bake like cookies.

German Christmas Cookies.—One quart honey; let come to a boil; then set away to cool. Add 1 pound brown sugar, 4 eggs, juice and rind of 2 lemons, ¼ citron chopped fine, 2 teaspoonfuls soda, 1 tablespoonful of cinnamon, 1 tablespoonful of cloves, 1 tablespoonful allspice, 1 tablespoonful of nutmeg. Flour to stiffen. Make dough as stiff as you can. Chopped nut-meats can also be added if desired.

Lemon Snaps.—Mix 1 quart honey, ½ lb. powdered sugar, ½ lb. fresh butter, and juice of two oranges or lemons. Warm just enough to soften the butter. Beat the mixture very hard. Add a

grated nutmeg. Mix in gradually 2 lbs. or less of flour. Make a dough hard enough to roll out easily. Beat it well all over with rolling-pin. Roll ⅜ inch thick; cut with tumbler dipped in flour. Bake well on tins buttered.

Oatmeal Cookies.—Cream together 1 cup sugar, ½ cup honey, ¾ cup lard or butter, 6 tablespoonfuls milk, ½ cup raisins, 2 cups rolled oats, 2 eggs; sift together 2 or more cups flour, ½ teaspoonful salt, 2 teaspoonfuls cream of tartar, 1 teaspoonful soda; 1 teaspoonful cinnamon. Mix together, and roll quite thick.

Doughnuts.—One egg, 1 cup sweet milk, 1 cup honey, 2 tablespoonfuls shortening, 1 heaping teaspoonful cream tartar, ½ teaspoonful soda. Flour to roll and cut easily. Pinch of salt.

Doughnuts.—Take two eggs; butter, the size of an egg; 1½ cupfuls alfalfa honey; 1 cupful of sour milk to which has been added 1 teaspoonful of soda and flour to roll, to which add 2 teaspoonfuls of cream of tartar.

Genuine Nuremberg Lebkuchen.—(German Christmas cookies.) Boil a quantity of honey till it forms pearls as it drips from a spoon, then pour out and cool off somewhat. Mix with flour until it forms a stiff dough. Let the dough stand 8 to 14 days. For 10 lbs. of this dough (for a smaller quantity use proportionately less), add 2 heaped tablespoonfuls of baking soda dissolved in water; 1 heaped tablespoonful cinnamon, 2 teaspoonfuls ground cloves, 1 teaspoonful crushed cardamon, 2 tablespoonfuls anise seed, finely chopped rind of two lemons, ¾ lb. chopped almonds, ¼ lb. citron. Work the dough until it becomes soft enough to be easily rolled out with a rolling-pin. Roll flat cakes of any desired shape. Dissolved baking soda must be added gradually, otherwise dough will become sticky.

Sugar Cookies.—One and one-half cups sugar, ½ cup honey, ½ cup butter or lard, ¾ cup sour milk, 1 level teaspoonful soda, ½ nutmeg, grated, 1 pinch of salt. Add flour to make a rather soft dough. Roll out to ¾ inch thick, and bake in quick oven.

BREAD, GEMS, ETC.

Brown Bread.—One heaping coffee-cup of corn meal; 2 cups graham flour; sift closely together, then beat together with 1 cup of honey, 2 cups sweet milk, 1 cup sour milk, 1 dessertspoonful soda and 1 teaspoonful salt. Place in form, and steam 3½ hours.

Brown Bread.—One cup corn meal, 1 cup rye meal, 1 cup sour milk, ½ cup or less of honey; a teaspoonful of salt and a teaspoonful of soda. Steam 4 hours, and then dry in the oven 15 minutes. It may be added that most of the molasses now sold is not fit to eat, and in any case honey is much better.

Steamed Brown Bread.—Two cups graham flour, sometimes heaped, depending on condition of milk, 1 cup meal, 2-3 cup dark honey or sugared honey, 2 cups sour milk, 1 teaspoonful salt, 2 teaspoonfuls soda dissolved in one tablespoonful boiling water, stirred into the milk and honey; ½ cup raisins. Stir thoroughly; fill pound baking-powder cans half full; cover tight, and steam 3 hours.

Graham Bread.—Three cups graham flour, 1 tablespoonful salt (scant), 2-3 cup honey, 2 cups sour milk, 1 teaspoonful soda dissolved in warm water; pinch baking powder; a few nuts chopped fine. Bake 1 hour and 15 minutes.

Graham Bread.—One pint sweet milk, ½ cup extracted honey, 1-3 cup sugar, 1 teaspoonful soda, a pinch of salt, 2½ cups graham flour. Stir all into a batter in a vessel in which it shall be steamed for 3 hours. Then remove from the steamer and bake ½ hour.

Graham Bread.—One and one-half cups sour milk, ½ cup shortening, 2-3 cup honey, 1 egg, 1 teaspoonful soda, 3 cups graham flour.

Honey Graham Biscuits.—Use 2 cups graham flour, 2 cups white flour, ½ cup butter, ½ cup honey, 2 teaspoonfuls baking powder. Sift the flour and baking powder well together; rub the butter into the flour thoroughly. Add the honey, and just enough sweet milk to make a soft dough. Roll out and bake in a quick oven.

French Muffins.—One and one-half pints flour, 1 cup honey, ½ teaspoonful salt, 2 teaspoonfuls baking powder, 2 tablespoonfuls butter, 3 eggs, and a little over half pint milk or thin cream. Sift together the flour, salt, and powder; rub in the butter cold; add beaten eggs, milk, and honey. Mix smoothly in batter as for pound cake. About half fill sponge-cake tins, cold and fully greased, and bake bread in good steady oven for eight minutes.

Gems.—Two quarts flour, 3 tablespoonfuls melted lard, ¾ pint honey, ½ pint molasses, 4 heaping tablespoonfuls brown sugar, 1½ level tablespoonfuls soda, 1 level teaspoonful salt, 1-3 pint water, ½ teaspoonful extract vanilla.

Cornmeal Cake.—One cupful cornmeal (yellow), ¾ cupful white flour, putting both in flour sieve; add one level teaspoonful soda and a rounding teaspoonful cream of tartar, and sift all together; then add 1 cupful of honey, ½ cupful of shortening; add enough sweet milk to mix to a batter that will not run, but drop from spoon in a lump. Bake one-half hour in hot oven.

Gems.—Take 1 cup buttermilk, ¼ cup sour cream, ½ cup best quality extracted honey, ¼ cup white sugar, 2 well-beaten eggs, 4 tablespoonfuls cottolene or lard, 1 teaspoonful of salt and soda. Sift together cornmeal and flour, one-half of each, with 2 tablespoonfuls of corn starch—enough to make a good batter, not too stiff. Butter may be used for shortening, leaving out salt. Bake in gem-pans.

Bran Gems.—Take 2 cups bran, 1 scant cup wheat flour, 1 large pinch salt, 1½ cups buttermilk, 1 level teaspoonful soda, 3 tablespoonfuls strained honey. Mix the bran, flour, and salt thoroughly, add buttermilk, in which soda has been dissolved; lastly, add honey. Bake until (crusty) thoroughly done in greased gem-pans in a hot oven.

MISCELLANEOUS.

Honey Cereal Coffee.—Use 1 egg, 1 cup honey (preferably dark), 2 quarts wheat bran. Beat the egg, add honey, and lastly the bran, and stir until well blended. Put in oven and brown to dark brown, stirring frequently, being careful the oven is not too hot. To prepare the coffee, allow one heaping tablespoonful to a cup of hot water, and boil for at least ten minutes.

Peach Preserves.—Pare and halve nice large peaches the night before. Pour 1 pound of honey to every 1½ pounds of fruit.

Plum Butter.—Take 4 quarts of plums after being rubbed through the colander. Let it come to a boil; then add 1 quart of honey and 1 quart of sugar, or 2 quarts of honey, and boil until it crusts on top when cooled, or about fifteen minutes. Stir frequently to prevent burning.

Apple Butter.—One gallon good cooking apples, 1 quart honey, 1 quart honey vinegar, 1 heaping teaspoonful ground cinnamon. Cook several hours, stirring often to prevent burning. If the vinegar is very strong, use part water.

Bar-le-Duc Preserves.—These preserves are believed to be the finest of their kind, and have hitherto been imported at extravagant prices. Other fruits besides currants may be treated in this way, as honey is of itself a preservative. These preserves do not require to be kept absolutely air-tight.

Take selected red or white currants of large size, one by one; carefully make an incision in the skin ¼ of an inch deep with tiny embroidery scissors. Through this slit remove the seeds with the aid of a sharp needle; remove the seeds separately, preserving the shape of the fruit. Take the weight of the currants in honey, and when this has been heated add the currants. Let it simmer a minute or two, and then seal as for jelly. The currants retain their shape, are of a beautiful color, and melt in the mouth. Care should be exercised not to scorch the honey; then you will have fine preserves.

Custard.—Use 1 egg, 1 tablespoonful honey (or more to suit individual taste), 1 cup rich milk, nutmeg or other flavoring. Beat the eggs, and add the honey and other ingredients.

Honey Beans (Navy).—Place 1 onion, ¼ pound bacon, and butter the size of an egg in the bottom of a bean-pot or iron spider. Pour over the beans 2 tablespoonfuls olive or cooking oil, and 2 tablespoonfuls best quality extracted honey. Lay sliced Greening apples to cover over the top of beans. Soak the beans and bacon over night. Keep moist while baking. Bake until well done. Add pepper to suit taste.

Baked Beans.—Boil 2 pints of beans in slightly salted water until tender; then add 1 cupful of extracted honey and ½ cupful of butter, with salt and pepper to suit taste. Bake in a covered baker until solid, but not dry.

Summer Drink.—One spoonful fruit juice and 1 spoonful honey in ½ glass water; stir in as much soda as will lie on a dime, and then stir in half as much tartaric acid, and drink at once.

Filling for Layer Cake.—Take 1 tablespoonful of lemon-juice, 2 heaping tablespoonfuls of granulated honey; stir to a smooth cream. When cake is done, lay on a plate hot; spread with the honey while hot.

Pickled Grapes in Honey.—Seven pounds good grapes (wine grapes if possible) on the stalks, carefully packed in a jar without bruising any of them. Make a syrup of 4 pounds of honey, a pint of good vinegar with cloves, etc., to suit the taste. Then boil the syrup, carefully skimming it, for twenty minutes. While boiling hot, pour the syrup over the grapes and seal up. This will keep perfectly for years, as the honey is a preservative.

Honey Crab-apple Jelly.—Boil fruit with as little water as possible; squeeze through a jelly-bag. Add ½ cup of honey and ½ cup of sugar to 1 cup of juice; then boil about twenty minutes, or until it begins to jell. Pour into glasses. Do not cover up until cool.

Baked Apples.—Split some sour apples, cut out the core, and fill pan. When they begin to soften, fill the cavity with some honey and lemon juice. Set back in stove to finish baking.

Salad Dressing.—Take 1 egg, well beaten, with 2 dessertspoonfuls honey. Add a pinch of salt; pepper to taste; ¼ teaspoonful of mustard. Stir well together, and add ½ cup of vinegar. Let come to a boil, stirring constantly. Cool, and add ½ pint of sweet cream just before using.

Salad Dressing.—Take the yolks of 4 eggs, beat well, add 4 tablespoonfuls cider vinegar, 2 tablespoofuls butter, 2 tablespoonfuls honey, 1 teaspoonful mustard. Mix thoroughly together, and cook in a double boiler to a smooth paste, stirring constantly. Mix with thick sweet cream, when ready to use. It will keep two weeks in a cool place.

Steamed Pudding.—Use 2 eggs, 2-3 cup honey, 1 cup chopped raisins, ½ teaspoonful salt, ½ teaspoonful soda, ½ teaspoonful cinnamon, ¼ teaspoonful cloves, ½ teaspoonful allspice, 2 teaspoonfuls baking powder, 2 tablespoonfuls ground chocolate, 1 cup sweet milk, 1¼ cups flour; more if needed. Steam three hours.

Mince Meat.—Four pounds of apples, pared, cored, and minced; 1½ pounds of raisins, stoned and minced; 4 pounds of beef suet shredded, or 2 pounds butter; 1 pound honey and ½ pound sugar; ¼ pound of mixed spices, minced rind of 4 lemons and juice of two lemons. Make a month before using. If apples are very sour, use more honey.

Buckwheat Pancakes.—Take scant 2 quarts of water at a little below blood heat—cooler if weather is warm; dissolve salt in the water till it tastes almost briny; 2-3 compressed yeast cake, thoroughly mixed in water before flour is added. Mix in the water a large tablespoonful of liquid honey; add the buckwheat flour through a sieve. The batter should then be stirred or beaten a long time. If any batter is left, set away in a cool place, not too tightly covered. When ready for the next batch add the necessary quantity of salted warm water and the honey; stir thoroughly, and then add the buckwheat as before. It is better to mix a little too thick rather than too thin. Water can be safely added before baking, if necessary. If sour in the morning from being kept too warm, use a little baking soda, dissolved in warm water. The old batter is useless after the soda treatment.

Buckwheat Pancakes.—When buckwheat pancakes are raised over night and the soda is put in when ready to bake, add one or two spoonfuls of extracted honey. It makes them bake nice and brown, and gives them a fine flavor.

Junket.—To a pint of milk, just warm, add 2 dessertspoonfuls of honey and ½ junket tablet, dissolved in cold water; flavor to taste. Set in a warm place until firm.

HONEY CANDY.

Caramels.—Take 1 pint honey, 1 teaspoonful cinnamon or vanilla, ½ pound cocoa, ¾ pound pecan nuts, 2 pounds sweet almonds. Cut the nuts fine, and boil them with other ingredients until thick. Cool and roll out. Cut in squares and dry in the oven.

Caramels.—One cup extracted honey of best flavor; 1 cup granulated sugar; 3 tablespoonfuls sweet cream of milk. Boil to "soft crack," or until it hardens when dropped into cold water, but not too brittle—just so it will form into a soft ball when taken in the fingers. Pour into a greased dish, stirring in a teaspoonful extract of vanilla just before taking off. Let it be ½ or ¾ inch deep in the dish; and as it cools cut in squares and wrap each square in paraffine paper, such as grocers wrap butter in. To make chocolate caramels, add to the ioregoing one tablespoonful melted chocolate, just before taking off the stove, stirring it in well. For chocolate caramels it is not so important that the honey be of best quality.

Taffy.—Boil some honey until it hardens when dropped into cold water. Pull until it becomes white. Any quantity may be used. A pound re-

quires twenty minutes' boiling and stirring. Great care must be exercised not to burn the honey. It makes very fine taffy.

PEANUT HONEY CANDY.—Take 1 cup butter, 2 cups honey, 2 cups sugar, 1 cup boiling water, ¼ teaspoonful cream tartar, ½ teaspoonful glycerin, a tiny dash of soda. Boil ten minutes to a soft ball, and set in cool place. When it has cooled slightly, stir in one or two tablespoonfuls of peanut butter, or to suit the taste; keep stirring till creamy; then pour into buttered pans; mark in squares.

PEANUT CANDY.—Use 1 cup honey, 1 cup granulated sugar, 4 tablespoonfuls sweet cream. Boil until it cracks when dropped in cold water. Remove from the fire and stir in a pound of peanuts that have been previously shelled and well crushed with the rolling-pin. Pour into a greased pan and set to cool.

PEANUT ROLLS.—Take 1 cup butter, 2 cups honey, 1 cup boiling water, ¼ teaspoonful cream tartar, ½ teaspoonful glycerine, a tiny dash of soda. Boil ten minutes; pour over a layer of rolled peanuts which have been scattered evenly over the bottom of the buttered pan. When nearly cold, mark off in long strips and roll up tight; then slice across with a sharp knife, before it gets quite cold.

HONEY CHOCOLATE.—Chocolate sweetened with honey rather than with sugar is excellent. Here is how it is made: Melt 1 pound of gelatine in a pint of water; add 10 pounds of honey, thoroughly warming the same, and then add 4 pounds of cocoa. Flavor with vanilla when taken off the fire, and then pour into greased dishes or molds.

FRENCH CANDIES.—In an enameled sauce-pan melt 1 part of gelatine in 1 part of water, stirring well. When at the state of a soft paste, add 4 parts of honey previously warmed, stirring lively. Take from the fire; add the desired flavor and color, mixing carefully, and pour into a shallow lightly greased dish. Let it dry for a few days.

NOUGAT.—Take 3 cups granulated sugar, 1½ cups any kind nut meats, 2-3 cup honey, 2-3 cup hot water, white of one egg beaten stiff. Boil the sugar, honey, and water together until they make a rather hard ball when dropped in cold water. Remove from the fire, pour in the beaten white of the egg, and beat briskly with a silver fork. After beating a while, pour in the nut-meats and beat until it begins to form a hard creamy mass, then pour into a buttered tin to cool.

TAFFY.—Use 3 cups sugar, 2-3 cup extracted honey, 2-3 cup hot water. Boil all together till it spins a thread when dropped from a spoon, or hardens when dropped into cold water. Pour into a greased vessel. When cool, pull until white.

POPCORN BALLS.—Use 2 gallons of corn, 2 cups granulated sugar, 3 tablespoonfuls honey, 2 tablespoonfuls apple vinegar, ½ cup of water. Stir together and boil until it will rattle in water. Then pour over the corn, and mix well. Dampen the hands in cold water and form into balls.

POPCORN BALLS.—Take 1 pint extracted honey; put it into an iron frying-pan, and boil until very thick; then stir in freshly popped corn, and, when cold, mold into balls. These will specially delight the children.

GOOD CANDY.—Use 2½ cups sugar, ½ cup honey, ½ cup water. Boil until thick syrup. Pour one cupful of syrup on the beaten whites of 2 eggs, stirring meanwhile. Boil remainder of syrup till it hardens when dropped in water; then pour it into the syrup and eggs, stirring briskly. Add a cupful of peanuts. Stir until it begins to harden; then spread in a pan and cut in squares. Flavor to taste. If properly made it will be soft and pliable.

CRYSTALLIZED HONEY POPCORN.—Take 1 teacupful water-white honey, 1 teacupful white sugar, 1½ tablespoonfuls butter, 1 tablespoonful water. Boil until brittle on being dropped in cold water. Have ready 2 quarts of nicely popped corn, and pour the candy over until evenly distributed over the corn, stirring briskly until nearly cool.

HONEY CANDY.—Take 1 cup sugar, 2 tablespoonfuls honey, 2 tablespoonfuls of water, walnut meats. Cook and test like molasses candy.

CANDY.—Granulated sugar 1 cup; strained honey 1 tablespoonful; butter, size of walnut; sweet cream enough to dissolve the mixture. It does not need much cooking. When taken from the fire, beat with a spoon until smooth.

HONEY REMEDIES.

COUGH SYRUP.—One-third teaspoonful of powdered ipecac dissolved in 1 teaspoonful of cold water. Add a teacupful of warm water, a tablespoonful of extracted or strained honey, and boil down half.

HONEY AND TAR COUGH-CURE.—Put a tablespoonful liquid pine tar into a shallow tin dish and place it in boiling water until the tar is hot. To this add a pint of extracted honey and stir well for half an hour, adding to it a level teaspoonful pulverized borax. Keep well corked in a bottle. Dose, teaspoonful every 1, 2, or 3 hours, according to severity of cough.

COUGH SYRUP.—Buy a five-cent package of lobelia herb; put about ⅛ of it in a large cup of good cider vinegar; put it in a granite dish to simmer on the stove for not less than ½ hour, but do not let boil after the strength is well out of the herb. Strain, put back on the stove, stir in about as much honey as you have used vinegar. See that the honey is well mixed while hot. Bottle ready for use. Dose, about ¼ teaspoonful every 15 minutes if the cold is bad.

COUGH SYRUP.—Make 3 pints of strong tea by boiling a good-sized bunch of old field balsam in a covered vessel; strain, add 1½ cups of sugar; boil to 2 pints; take from the fire; add a small teaspoonful of pine tar; let cool five minutes, then add ½ cup of strained honey. Dose: 1 teaspoonful as often as needed—2 to 4 hours, according to the case.

FOR COLDS.—Boil 2 ounces of flaxseed in a quart of water; strain, and add 2 ounces of rock candy, ½ pint of honey, juice of 3 lemons. Mix, and let all boil well. Let cool and bottle. Dose: One cupful on going to bed; ½ cupful before meals; the hotter the better.

TOOTH-PASTE.—Eight ounces precipitated chalk, 4 oz. powdered castile soap, 4 oz. orris-root powder, 2 oz. essence of wintergreen, and honey to make a paste.

HONEY FOR FRECKLES.—Half a pound of honey, 2 oz. glycerine, 2 oz. alcohol, 6 drams citric acid, 15 drops ambergris. Apply night and morning.

BALM OF GILEAD SALVE.—Four ounces mutton tallow; 1 pint balm-of-Gilead buds; 3 ounces loaf sugar; 1 ounce castile soap; 1 ounce rosin; 3 ounces beeswax; 1 ounce alum; 1 pound lard. Put the buds in a kettle with the lard, and boil slowly for half an hour, stirring often. Strain, and take the buds out. Put in the rest of the ingredients, and cook slowly until done. This usually takes from one-half hour to an hour; excellent for chapped hands or lips, sores, or cuts, frost bites, and piles.

HONEY AS A SOFTENER OF THE HANDS.—Many are unaware that the very best cosmetics are made

with honey as a prime ingredient. Here is one for the hands, which is said to be very fine: Rub together 1 lb. of honey and the yolks of 8 eggs; gradually add 1 lb. oil of sweet almonds, during constant stirring; work in ½ lb. bitter almonds, and perfume with 2 drams each of attar of bergamot and attar of cloves. Of course, the quantities may be reduced if necessary.

Honey Soap.—Cut 2 pounds of yellow soap in thin slices and put into a saucepan with sufficient water to prevent the soap from being burned. Place on the fire, and as soon as all the soap has dissolved add 1 pound of honey and stir until the whole begins to boil. Then remove from the fire, add a few drops of essence of cinnamon, pour into a deep dish to cool, and then cut into squares. It improves by keeping.

Honey-paste for Chapped Hands.—An excellent paste for chapped hands is made as follows: The white of 1 egg, 1 teaspoonful of glycerine, 1 ounce of honey, and sufficient barley flour to compose a paste.

Cold Cream.—One cup of honey, ¾ of a cup of beeswax, 1 cup of cottolene. Melt all, take it off the fire, and stir till it is cool. Rose or violet perfume may be added. It should be well protected from the air. The blending should be well done. This is fine for chapped or rough hands, if they are slightly moistened before applying.

Polish for Kid Shoes.—Beeswax softened with neatsfoot oil. The composition is made by mixing the oil with the melted wax so as to be, when cold, about like butter, soft enough to "spread." A small portion of lampblack is also mixed in while the mass is melted. If there is any ordinary shoe polish on the shoes, it should be washed off and the surface allowed to dry. An old toothbrush can be used to apply a thin even coat, which is then polished with a soft woolen rag, see-sawed across the surface.

Waterproofing for Leather.—Take 2 pounds tallow, 1 pound resin, ½ pound beeswax. Melt over a slow fire; and before applying to the uppers of boots or shoes, fill the leather with neatsfoot oil, as there is less danger of burning the leather, and they will keep soft and pliable longer. For the soles use the tallow and resin in equal parts. Be careful not to burn the leather.

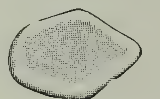
HONEY-BOARDS. See Comb Honey, and Hives.

HONEYCOMB.—A beautiful thing in nature is a piece of comb honey with its snowy whiteness and its burden of sweetness. Aside from its whiteness and sweetness, the marvelous structure of the comb compels our admiration. The walls of its cells are so thin that from 3000 to 4000 of them must be laid one upon another to make an inch in thickness, each wall so fragile as to crumble at a touch, and yet so constructed that tons of honey stored in them are transported in safety thousands of miles.

Formerly the word "honeycomb" meant both the comb and the honey contained in it; in other words, what we now call "comb honey" was called "honeycomb." Wherever the word "honeycomb" is found in the Bible, it means "comb honey."

It is only in comparatively recent years that the real source of the wax of which comb is constructed has been known. In 1684 Martin John discovered that with the point of a needle he could pick scales of real beeswax from the abdomen of a bee working at comb-building.

These wax scales may be found plentifully on the floor of a hive at a time when much comb-building is going on; and, in fact, more or less of them may be found at almost any time of the year. They are somewhat pear-shaped, as shown at the left,



Wax scale.

Jaw of a worker bee.
—*After Cheshire.*

where is shown also the powerful jaw of the worker by which the wax is worked. These wax scales are much more brittle than the wax that has been worked into comb, and are transparent, looking somewhat like mica. Some say they are white, some say pale yellow. Likely enough both are right, the color depending upon the pollen consumed.

These wax scales are secreted by eight wax-glands on the under side of the abdomen of the worker bee, as seen in the cut below. Examine a swarm lately hived, and

Wax scales on the under side of the abdomen of a worker.—*After Cheshire.*

you will find plenty of bees showing this appearance. When first secreted, wax is liquid. It is derived from the blood of the bee by cell action. So it is an expensive product, and one might well say it is derived from the "sweat and blood"

of the bee, for it is sweat out from the blood by the wax-glands. Just how expensive it is seems a hard matter to learn. For many years the stereotyped expression was, "Every pound of wax requires 20 pounds of honey for its production." Later investigations have cut down that estimate greatly. But there is no agreement. Some estimate as low as 3 or 4 pounds of honey to one of wax. Others say 7, 15, or some other number.

Some hold that the secretion of wax is involuntary, and that, if not utilized, there will be so much dead waste, and so nothing can be gained by trying to save the bees the work of secretion. But this is by no means the general view. Cowan says, "The Honey Bee," page 171, "Wax is not produced at all times, but its secretion is voluntary." The practically unanimous agreement among beekeepers, that a very much larger quantity of extracted than of comb honey can be obtained, is hard to explain without admitting that the furnishing of drawn combs saves the bees much labor in the way of wax-production, and that that production depends on conditions that come largely under the control of the beekeeper.

A high temperature favors the secretion of wax, and when it is produced in large quantities the bees hang inactively in clusters or festoons.

"Wax is not chemically a fat or glyceride," says Cheshire, "Bees and Beekeeping," Vol. I., page 160, "hence those who have called it 'the fat of bees' have grossly erred; yet it is nearly allied to the fats in atomic constitution, and the physiological conditions favoring the formation of one are curiously similar to those aiding in the production of the other. We put our poultry up to fatten in confinement, with partial light; to secure bodily inactivity we keep warm, and feed highly. Our bees, under Nature's teaching, put themselves up to yield wax under conditions so parallel that the suitability of the fatting-coop is vindicated.

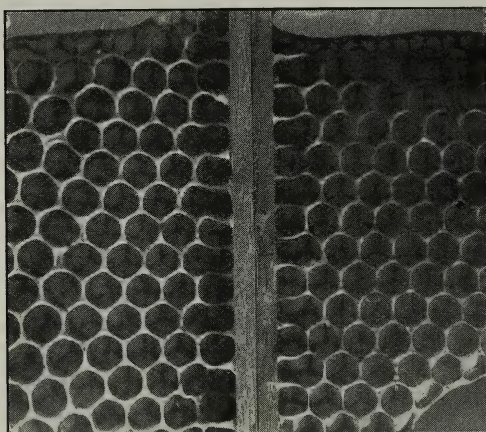
"The wax having been secreted, a single bee starts the first comb by attaching to the roof little masses of the plastic material, into which her scales are converted, by prolonged chewing with secretion; others follow her example, and the processes of scooping and thinning commence, the parts removed being always added to the edge of the work, so that, in the darkness, and between the bees, grows downward that wonderful combination of lightness and strength, grace and utility, which has so long provoked the wonder and awakened the speculation of the philosopher, the naturalist, and the mathematician."

A chief use for the honeycomb being to furnish cradles for the baby bees during their brood stage, the problem is to find what arrangement will accommodate them in the least space and with the least expenditure of wax. If a bundle of lead-pencils be tied tightly together, they will assume the arrangement of a series of circles, and no other arrangement can possibly accommodate them in less space. That gives us the hint, then, to scoop out cylindrical holes in a mass of wax, with the same arrangement, leaving only very thin walls at the places corresponding with the points where the pencils touched each other.

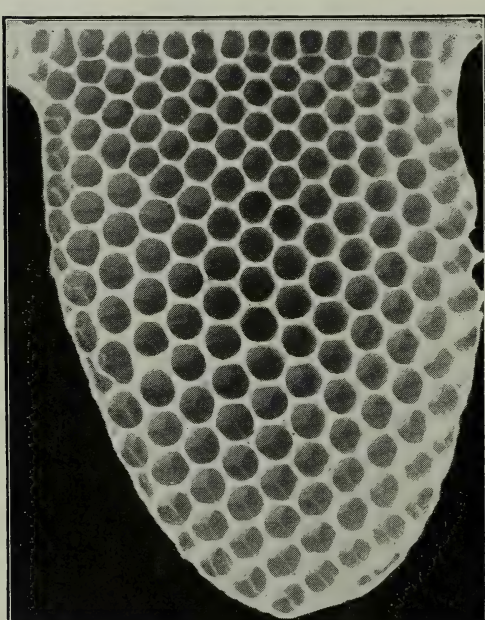
That complies with the requirement to have the cells in the least possible space; but it requires a great amount of wax. There is no need to have the walls thicker at one point than another, so all the wax may be scooped out until the entire walls shall be as thin as at the thinnest part. That leaves us a hexagon—precisely the thing the bees have adopted.

Having settled the arrangement of cells on each side of a honeycomb, the next question is how to let the two sets abut one against the other with the least waste of room and wax. Let a single layer of marbles fill a plate. Then these marbles may in a crude way represent the bottoms of one series of cells, or the cells on one side. How shall another layer of marbles be placed upon these with the best economy of room? Place a single marble upon the layer, and it will at once settle down, resting upon three of the lower marbles. Add other marbles, finishing out the second layer, and we have the least possible waste of space between the two layers. That gives the cue for the best way to have the cells of one side abut against the cells of the other side. Scoop out all unnecessary wax, leaving a thin wall that shall lie tangent to the circumference of each two marbles at their point of contact, and we have at the bottom of each cell three lozenge-

shaped plates, these three lozenges helping to form the bottoms of three of the cells on the opposite sides. But without all this trouble we might have found the same thing by examining a honeycomb, for this arrangement is exactly the one used by the bees in building the septum, or middle wall between the two series of cells.



How combs are attached to a vertical support.



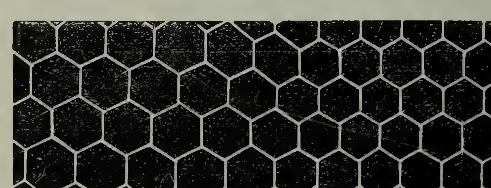
A characteristic spur of natural comb built from a horizontal support.

By far the larger portion of the cells in a hive will be found to measure about five to the inch. These are called worker-cells, and may be used for rearing worker-brood, or for storing honey or pollen. A smaller number of cells will be found to measure about four to the inch. These are called drone-cells, and may be used for rearing drone-brood, or for storing honey—seldom for pollen.

If the worker-cells were exact hexagons measuring five to the inch, there would be exactly 28 13-15 cells to the square inch on one side of a comb. But there is not this exactness, as will be shown by careful measurement, although the eye may detect no variation. Count the number of cells in a given length in a horizontal row of cells, and then make the same count in one of the diagonal rows, and you will find they are not precisely the same. That shows that the cells are not exact hexagons. Measure the cells in a number of combs built by different colonies, or even by the same colony, and it will be found that they are by no means all of them five to the inch.

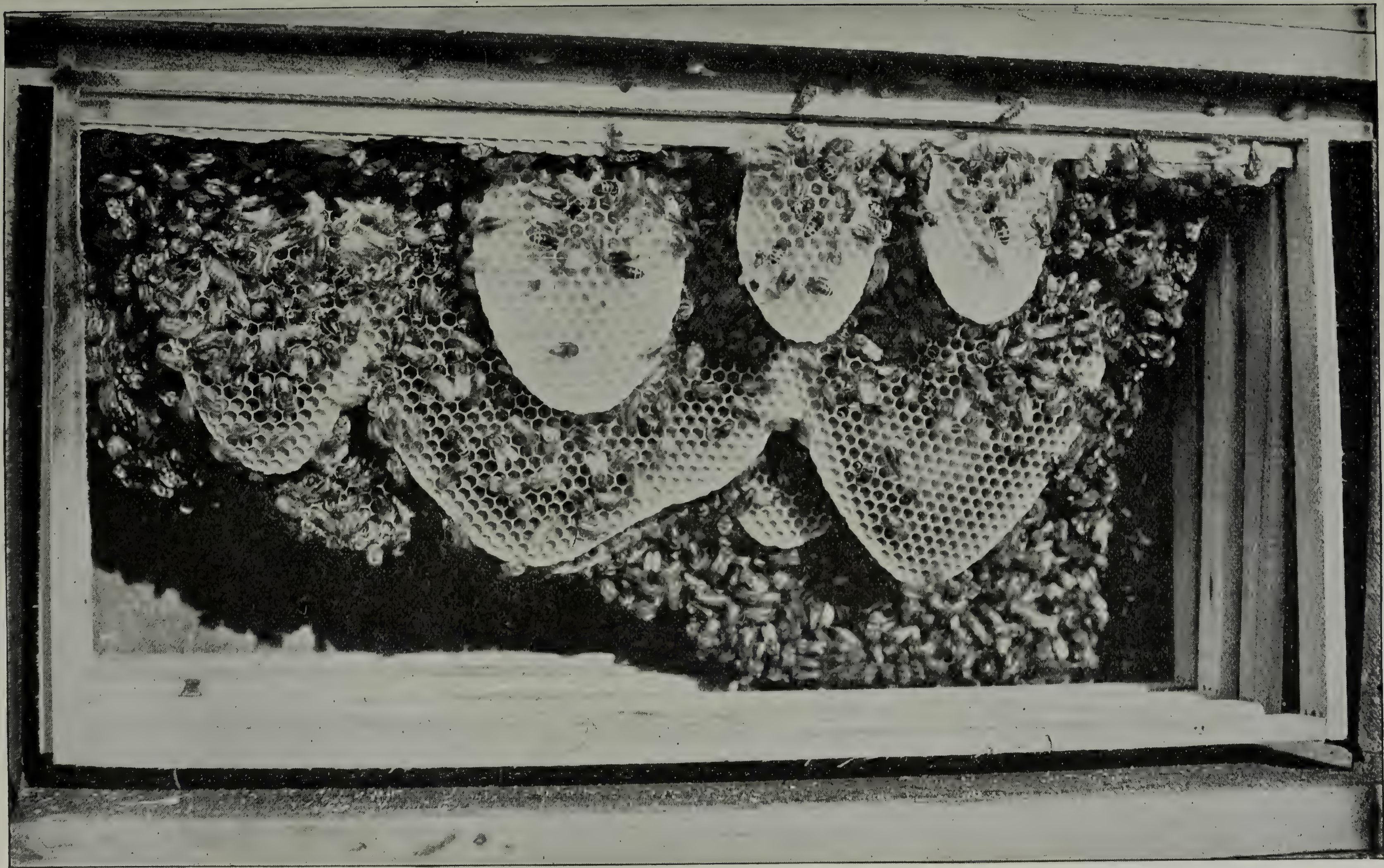
This, of course, refers to natural comb built by the bees without any comb foundation being supplied to them. Comb foundation is generally made with cells of such size that worker comb built upon it contains about 27 cells to the square inch.

Instead of lessening our admiration, the slight variation from exactness in the work of comb-building, when the bees are left free to take their own course, rather increases it, just as a piece of "hand-made" work is often more admired than that which is "machine-made." The marvelous ingenuity displayed in adjusting the work



Drone comb. Worker comb.

to varying circumstances is something far beyond machine-like exactness. Cut a few square inches of comb out of the middle of a frame of worker comb in the middle of summer, and the chances are ten to one that the bees will fill the hole with drone comb. A few cells will be built that are neither drone-cells nor worker-cells, and these are called *accommodation cells*; but



Natural-comb building, illustrating how the several pieces of comb are joined together. Photographed by the late W. Z. Hutchinson.

so skillfully are the adjustments made in passing from worker to drone-cells that at a hasty glance one would likely say that all were either worker or drone cells. Observe the small pieces of comb started at different points on the same top bar on previous page. They may be at such distances apart that, when the two combs meet, if built with rigid exactness, the center of a cell in one comb will coincide with the edge of a cell in the other comb. Yet so skillfully are measurements made, and so gradual the change as one comb approaches the other, that the unaided eye can detect no variation from an unbroken comb of worker-cells, and the whole is such an exquisite work of skill as no human expert can equal. Who taught the bees to make such measurements?

Beside the worker and drone cells, queen-cells are built at times, and these are described under QUEENS.

In general, comb is built so that an angle is at the top and bottom of each cell, as in Fig. 1; and this is believed to give greater strength than if the cells were built like Fig. 2.

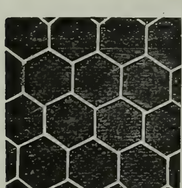


Fig. 1.

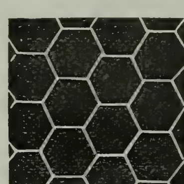
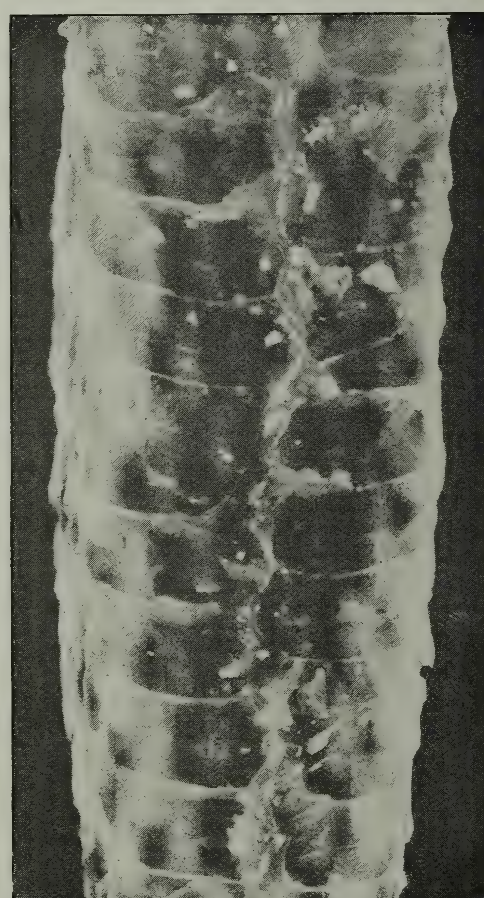


Fig. 2.

When combs are built upon foundation, the rows of cells run in a horizontal line with exactness. But when the bees build at their own sweet will, there is no little variation from the horizontal.

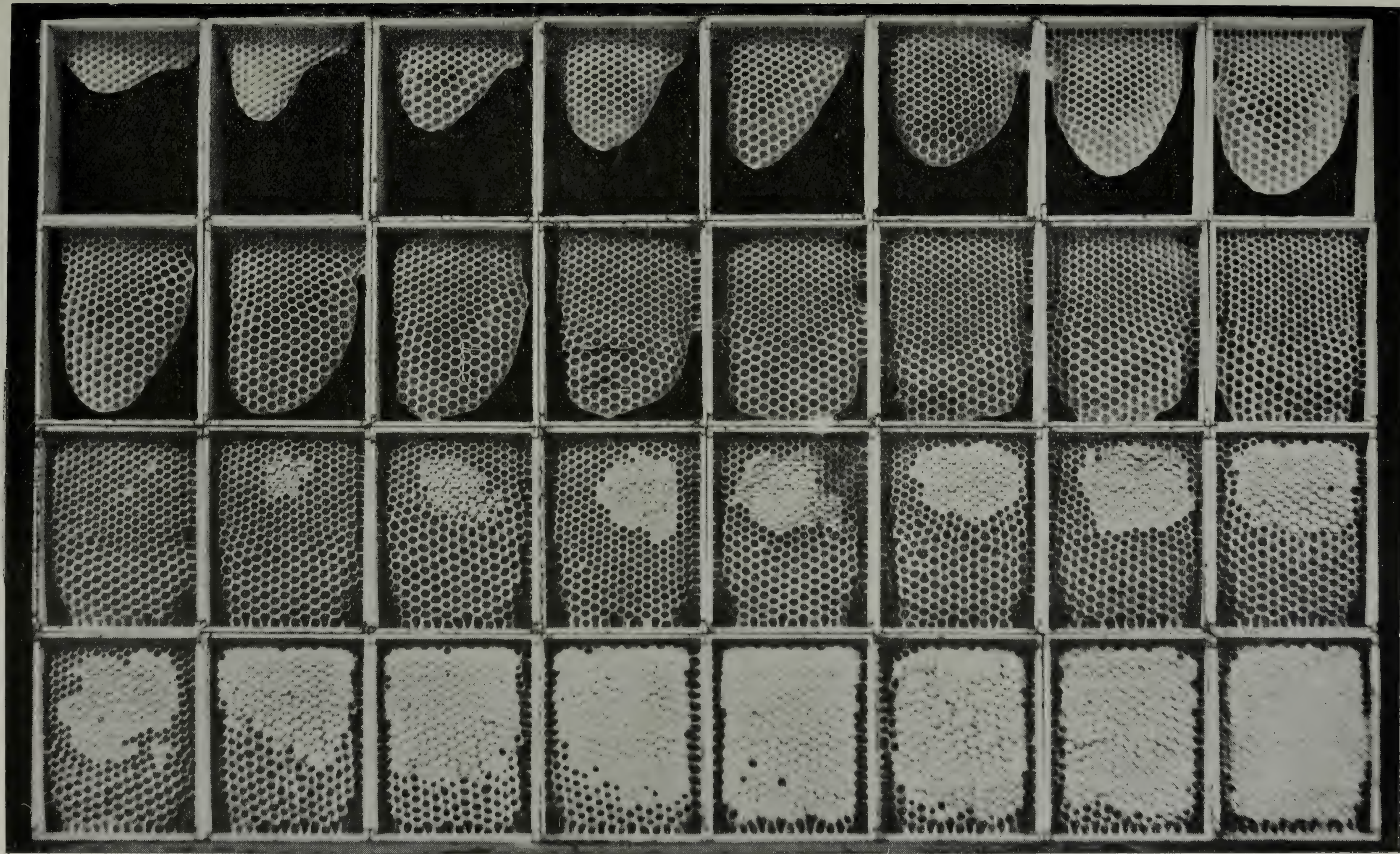
While the cell-walls vary from 1-3000 to 1-4000 inch in thickness, the septum is thinner, sometimes being as thin as 1-5000 of an inch when first built. But as successive generations of young bees are reared in the cells, secretions are left at the bottom of each, and in time the septum may become 1-8 inch thick. From this it happens that, although worker comb is $\frac{7}{8}$ inch thick when first built, specimens of old comb may be found measuring an inch in thickness, since the bees draw out the cell-walls at the mouth of the cell to balance the additions made at the bottom of the cell, so as to maintain the same depth in an old cell as in a new one.

When, however, worker-cells are used for storing honey, if there be room for it, the depth of the cells may be so increased that the comb may be two or three inches thick. Drone comb is even more likely to be thus built out. The cells of both kinds slant upward from the center to the exterior of the comb, yet so slightly that to the casual observer they appear entirely horizontal. Yet when the comb is so greatly thickened for the storing of honey, the slant may be much increased, giving the cell a curved appearance. See cut below.



Cross section of honeycomb, enlarged view. The cells are partly filled with honey. This illustration shows that the cells are not straight and horizontal, but curved and slanting upward.

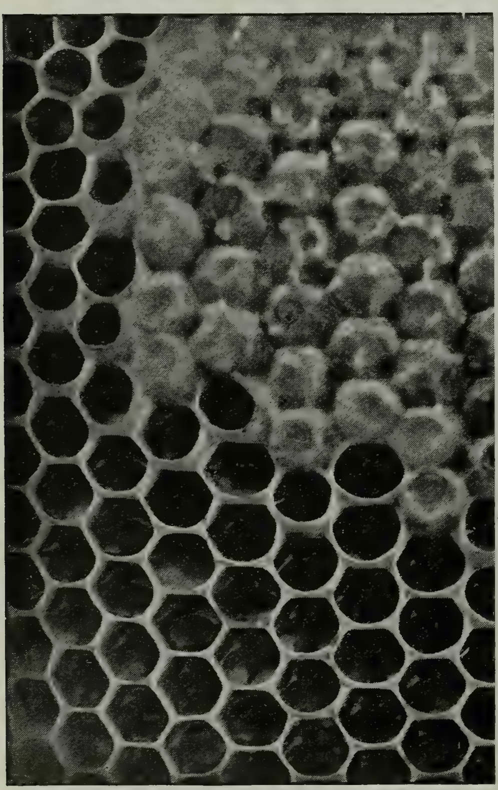
Formerly it was taught that the cappings placed over honey are air-tight, and this in spite of the fact that it is a common thing to see white comb honey become watery and dark when kept in a damp



The development of comb honey. These sections were selected from two supers of 32 sections

place, the thin honey finally oozing out through the cappings. Cheshire, who at one time held that the sealing of honey-cells is air-tight, says (Bees and Beekeeping, Vol. I., page 174), "By experiments and a microscopic examination, I have made evident that former ideas were inaccurate, and that not more than 10 per cent at most of the sealing of honey is absolutely impervious to air." The sealing of brood-cells, however, is very much more porous still, no doubt for the sake of allowing proper ventilation for the brood. The brood-cell cappings seem to be made up of shreds of cocoons, pollen, and almost any thing that comes handy, with only enough wax to weld the whole together.

The beautiful white color of honeycomb becomes dark with age, so as to become nearly black.



Drone cells used for honey storage. It will be seen that the lower part of the opening is capped first. This, with the slant of the cell, keeps the new honey from running out.

Drone comb measures just about four cells to the inch, but the bees seem less particular about the size of it than with the worker. They very often seem to make the cells of such size as to fill out best a given space; and, accordingly, we find them differing from worker size all the way up to considerably more than ¼ of an inch in width. Drones are raised in these extra-large cells without trouble, and honey is also stored in them; but where they are very large, the bees are compelled to turn them up, or the honey would flow out. Now, as honey is kept in place by capillary attraction, when cells exceed a certain size the adhesion of the liquid to the wax walls is insufficient, of itself, to hold the honey in place. Where drones are to be reared in these very large cells the bees contract the mouth by a thick rim. As an experiment, we had some plates made for producing small sheets of foundation, having only 3½ cells to the inch. The bees worked on a few of these, with these same thick rims, but they evidently did not like the idea very well, for they tried to make worker-cells of some of it, and it proved so much of a complication for their little heads that they finally abandoned the whole piece of comb, apparently in disgust.* Bees sometimes rear worker brood in drone comb, where compelled to from want of room, and they always do it in the way we have mentioned, by contracting the mouth of the cells and leaving the young bee a rather large berth in which to grow and develop. Drones are sometimes reared in worker-cells also, but they are so much cramped in growth that they seldom look like fully developed insects.

Several times it has been suggested that we enlarge the race of honey-bees by giving them larger cells; and some circumstances seem to indicate that something may be done in this direction, although we have little hope of any permanent enlargement in size unless we combine with it the idea of selecting the largest bees to propagate from, as given a few pages back.† By making the cells smaller than ordinarily, we get small bees with very little trouble; and we have seen a whole nucleus of bees so small as to be really laughable, just because the comb they were hatched from was set at an angle so that one side

* No "disgust." Some other cause. Bees too often work over comb, making drone cells on one surface when worker cells are on the other, put cells of either size on flat sheets of wax, wood, etc., to make the idea of "disgust" tenable.—A. C. M.

† Absolute waste of time and energy. No basis. —A. C. M.

was concave and the other convex. The small bees came from the concave side. Their light, active movements, as they sported in front of the hive, made them a pretty and amusing sight for those fond of curiosities. Worker-bees reared in drone-cells are sometimes extra large in size; but as to whether we can make them permanently larger by such a course is very doubtful. The difficulty, at present, seems to be the tendency to rear a great quantity of useless drones. By having a hive furnished entirely with worker-comb, we can so nearly prevent the production of drones that it is safe enough to call it a complete remedy.

HOW BEES BUILD COMB.

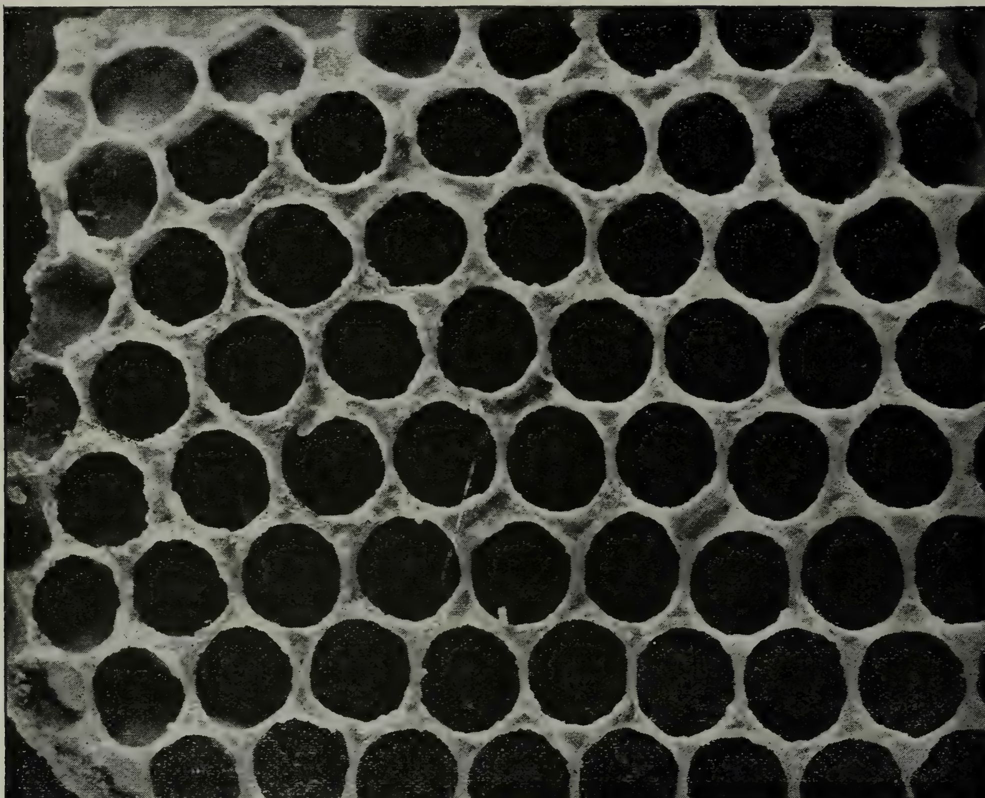
In this day and age of bees and honey it would seem that one should be able to tell how our bees build comb, with almost as much ease as they would tell how cows and horses eat grass; but for all that, we lack records of careful and close experiments, such as Darwin made many years ago. In our house-apiary there were dozens of hives where the bees were building right up close to the glass; and all one had to do, in order to see how it is done, was to take a chair and sit down before them. But the little fellows have such a queer sleight-of-hand way of doing the work that we hardly know how they do accomplish it.

If we examine our bees closely during the season of comb-building and honey-gathering, we shall find a good many of them with wax scales protruding between the rings that form the body, and these scales are either picked from their bodies or from the bottom of the hive or honey-boxes in which they are building. If a bee is obliged to carry one of these wax scales but a short distance, it takes it in its mandibles, and looks as business-like with it thus as a carpenter with a board on his shoulder. If it has to carry it from the bottom of the honey-box, it takes it in a way that we can not explain any better than to say it slips it under its chin. When thus equipped, you would never know it was encumbered with any thing, unless it chanced to slip out, when it will very dextrously tuck it back with one of its fore feet. The little plate of wax is so warm from being kept under its chin as to be quite soft when it gets back; and as it takes it out, and gives it a pinch against the comb where the building is going on, one would think it might stop a while, and put it into place; but, not it; for off it scampers and twists around so many different ways you might think it was not one of the working kind at all. Another follows after it sooner or later, and gives the wax a pinch, or a little scraping and burnishing with its polished mandibles, then another, and so on; and the sum total of all these maneuvers is, that the comb seems almost to grow out of nothing; yet no *one* bee ever makes a cell.

The finished comb is the result of the united efforts of the moving, restless mass; and the great mystery is, that any thing so wonderful can ever result at all from such a mixed-up, skipping-about way of working as they seem to have. When the cells are built out only part way they are filled with honey or eggs, and the length is increased when they feel disposed, or "get around to it," perhaps. It may be that they find it easier working with shallow walls about the cells, for they can take care of the brood much easier, and put in the honey easier too, in all probability; and, as a thick rim or coping is always left around the upper edge of the cell, no matter what its depth, they have the material at hand to lengthen it at any time. This thick rim (see next page) is also very necessary to give the bees a secure foothold, for the sides of the cells are so thin they would be very apt to break down with even the light weight of a bee.* When honey is coming in rapidly, and the bees are crowded for room to store it, their eagerness is so plainly apparent, as they push the work along, that they fairly seem to quiver with excitement;† but for all that, they skip about from one cell to another in the same way, no one bee working in the same spot to exceed a minute or two, at the very outside. Very frequently, after one has bent a piece of wax a certain way, the next tips it in the opposite direction, and so on until completion; but after all have given it a twist and a pull, it is found in pretty nearly the right spot. As nearly as we can discover, they moisten the thin ribbons of wax with some sort of fluid or saliva. As

* They can not help making the thick rim.—A. C. M.

† I think quite the contrary.—A. C. M.



Top view of honeycomb greatly enlarged, showing the thick circular rim or coping at the top of the cell.

the bee always preserves the thick rib or rim of the comb at the top of the cell it is working, the looker-on would suppose it was making the walls of considerable thickness as shown; but if we drive it away, and break this rim, we shall find that its mandibles have come so nearly together that the wax between them, beyond the rim, is almost as thin as tissue paper. In building natural comb, of course the bottoms of the cells are thinned in the same way, as the work goes along, before any side walls are made at all.

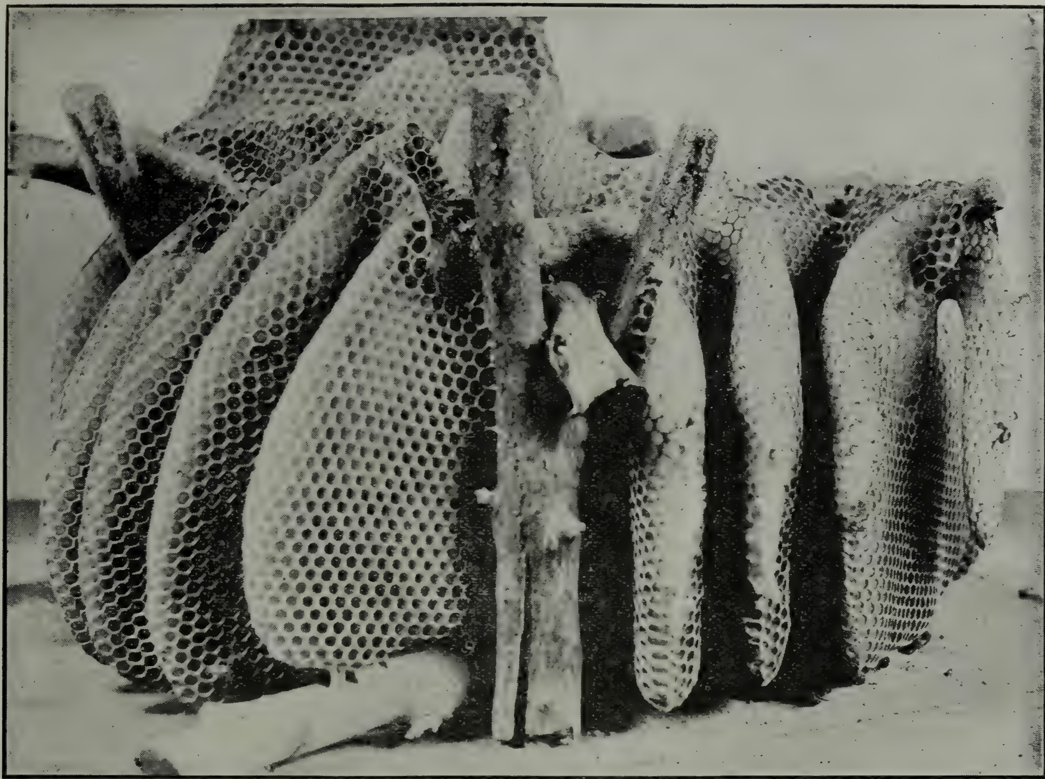
When no foundation is furnished, little patches of comb are started at different points, as shown in the engraving (page 335). Then as these patches enlarge, their edges are united so perfectly that it is sometimes difficult, when the frame is filled solid, to determine *where* the pieces were united, so perfect is the work. At other times there is, perhaps, a row of irregular or drone cells along the line of the union.

The midrib of natural comb becomes thicker as it approaches the line of support and tapers toward the bottom. Why this is so is evident. That there should be a gradual gradation in thickness from top to bottom seems wonderful when we remember the haphazard, skip-about work on the part of so many different bees.

For the consideration of the thickness of combs and how far to space them apart see Frames, Self-spacing; also Spacing of Frames; also Comb Foundation.

NO ARTIFICIAL COMB HONEY.

No one is so foolish as to claim that a suit of clothes made on a machine is any more "artificial" than one sewed by hand. It is simply economy of labor. Yet hundreds of persons have the incorrect notion that there is a honeycomb made from wood pulp, punk, putty, paraffine, or perhaps material other than wax. We say "foolish enough" advisedly, because a wise man changes his mind (when it becomes necessary); but a fool, never. It would not be surprising in these days of sensational journalism and of false nature-stories if one should get the notion that artificial comb honey really exists; but the foolish



Natural-comb building in a hive made entirely of glass.

Bees living on combs built in the open air.

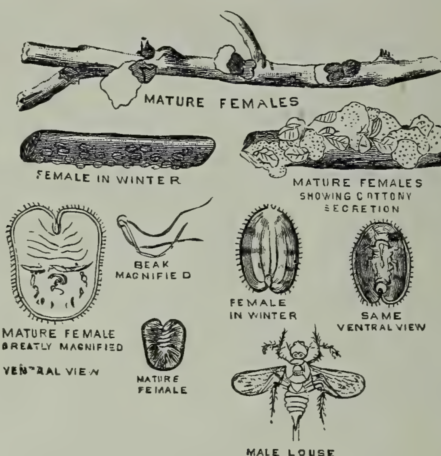
part comes in when a person, totally inexperienced with bees, stoutly and smilingly maintains that there is such a thing as manufactured honey in the comb. We feel sure that the inimitably foolish expression of such a person is the origin of the colloquialism, "The smile that won't come off." No use. Do not argue. It won't come. "Why, I've seen it at the stores. Grocer told me all about it—was several cents cheaper. I tried it; we didn't like it as well as the genuine." And then the beekeeper goes away, not a wiser but a madder man, and wonders why the fool-killer doesn't do his duty, and why every one except the beekeeper knows all about bees and their products. See Comb Honey, also Honey Exhibits.

HONEY-DEW.—So named because it was formerly supposed to come down from the heavens in the form of a saccharine spray, settling on the leaves of trees and low-growing shrubbery. It is now known to be almost, if not entirely, the product of aphides, or plant-lice, and coccids, or scale insects. These are sometimes found on the topmost limbs of a tree, and the honey-dew which they secrete is thrown out as a spray, which falls on the lower limbs and on the sidewalk* or grass. Observers, seeing the leaves of the lower limbs of trees and the grass covered with a sort of saccharine varnish, naturally came to the conclusion that this substance was a real honey-dew, and hence the name.

There are certain plants, particularly catalpa speciosa, which, under certain conditions, it is said, exude a sort of saccharine substance from the leaves, but, strictly speaking, this is not honey-dew. The ordinary "stuff" that is gathered by the bees, commonly called honey-dew, is nothing but a secretion from plant-lice. There are several species of honey-dew lice, among which may be named *Lecanium tiliae,* that attack the basswoods; *Lecanium tulipifera,* of the tulip tree, often called "poplar," and the scale or bark louse that attacks maple-trees, *Pulvinaria innumerabilis* (Rath.). Prof. Cook, formerly of the Michigan Agricultural College, now Horticultural Commissioner of California, professor of entomology, and a beekeeper of long experience, thus describes these lice:

* Sometimes the sidewalks in our town, in July and August, are spotted all over near the trees.

The maple-tree scale or bark louse (*Pulvinaria innumerabilis* Rath.) consists at this season (1884) of a brown scale five-eighths of an inch long, which is oblong, and slightly notched behind. On the back of the scale are transverse depressions, marking segments. The blunt posterior of the insect is raised by a large dense mass of fibrous cotton-like material, in which will be found about 800 small white eggs. These eggs falling on to a dark



surface look to the unaided eye like flour; but with a lens they are found to be oblong, and would be pronounced by all as eggs, at once. This cotton-like egg-receptacle is often so thick as to raise the brown scale nearly a fourth of an inch. The scales are found on the under side of the limbs of some trees, and are often so thick as to overlap each other. Frequently there are hundreds on a single main branch of a tree. I find them on basswood, soft and hard maple, and grapevines, though very much more abundant on the maples.

Another feature, at this mature stage of the insect, is the secretion of a large amount of honey-dew. This falls on the leaves below, so as fairly to gum them over, as though they were varnished. This honey-dew is much prized by the bees, which swarm upon the leaves. If such honey-dew is pleasant to the taste, as some aver, I should have no fear of the bees collecting it.

From the middle to the last of June, the eggs begin to hatch, though hatching is not completed for some weeks after it begins, so we may expect young lice to hatch out from late in June till August.

The young lice are yellow, half as broad as long, tapering slightly toward the posterior. The seven abdominal segments appear very distinctly. The legs and antennæ are seen from the other side. As in the young of all such bark-lice, the beak, or sucking-tube, is long and thread-like, and is bent under the body till the young louse is ready to settle down to earnest work as a sapper. Two hair-like appendages, or setæ, which soon disappear, terminate the body.

The same writer, in the *American Bee Journal* for January, 1899, gives his reasons for doubting the plant origin of honey-dew. He says:

1. I now have carefully examined this secretion for years, whenever seen, and have always found either aphides—plant-lice; coccids—scale insects; other hemipterous bugs; or else larvæ of insects (these are reported to me) often working in scores —to be the source of this nectar. This gives strong

presumption that such is always the source of honey-dew.

2. We have reason to believe in the economy of Nature, that energy is never expended by plant or animal that does not in some way benefit by such outgo. We are easily able to see how the insects profit by the secretion of this nectar. They thus lure bees, ants, wasps, etc., to their immediate presence, and these in turn repel the birds which else would feed on and destroy the insects.

I once noticed an exhibit of this function in Michigan, so palpably displayed that to doubt it was impossible. The *Lecanium tiliae*—a large black louse—was thick on a linden-tree close beside my study window. In early spring the beautiful song sparrow commenced to feed on the young scale insects which thickly dotted the leaves. Suddenly the bees and other sweet-loving insects commenced to visit the same leaves for the honey-dew which dropped from the coccids, and the birds at once ceased to come. In a few days cold, or, preferably, nectar in other places, kept the bees and their companions from the place, and the birds again commenced their good work. This alternation of bird and bee visits occurred several times. Such observations make the value of the expensive secretion to the insects clearly evident.

On the other hand, the honey-dew always becomes foul with the black smut or fungus that attacks sweet substances on tree or bush. We can hardly doubt that it is a serious evil to the plants, and are unable to see any good that comes to the plant from it. I fully believe it is always harmful to vegetation, and I feel certain that plants do not originate it to their own hurt.

I referred above to certain acorn-infesting larvæ that secrete nectar. I have never seen them, but have often heard of such—principally from Missouri—so often that I think they may be more than a myth. Yet I am free to say that I should feel more certain if I actually saw them. I can see how oak-tree plant-lice, which are by no means rare, might lead to an erroneous conclusion.

Ergot—a fungus which attacks rye and other plants—is also said to secrete honey-dew. If this be true, then I feel sure that the sweet in some way benefits the fungus. If it does the fungus no good, then I believe it, too, has other origin.

In California, where scale insects and aphids are so common, it is very easy to study the honey-dew, and the black repulsive fungus, which our orchardists denominate "smut." The walnut-tree, this season, has been infested generally with an aphid, and honey-dew and smut have always attended it.

It is not to be inferred that this honey-dew is unwholesome. It is a secretion, and not an excretion. It has a similar origin to honey, and may be as delicious. Much aphid honey-dew is deliciously wholesome, and the honey from it is superior. Most if not all of the coccid honey-dew, on the other hand, is dark and of ill flavor, and its presence in honey, or as honey, is greatly injurious, and can never be sold for the table. I have sold it by the barrel for manufacturing. This was used to make cookies, and was said to be all right by the manufacturer. I explained all to him, yet he gave the ruling price.

Often this honey-dew is produced in exceeding quantities, and I have known it to crystallize on plants, especially on pine and larch trees, so as to encrust them with white, and become very conspicuous.

Another authority, Prof. H. A. Surface, President of the Pennsylvania State Bee-keepers' Association, and State Zoologist, has this to say on the subject of the origin of honey-dew:

Honey-dew in this State is never found excepting on plants that are infested with certain scale insects, plant lice, or similar insects. It is true that it will be seen on the lower leaves of a tree before the insects get there; but this is because they often leave the trees by flying through the air and commence to feed on the tender new leaves of the upper part and drop their sweet secretions on the leaves below. Later they drop to the leaves below, or crawl down the tree, and may be seen on the lower leaves. This does not mean that honey-dew was on the leaves before the insects were there.

Honey-dew attracts ants, wasps, flies, bees, and other insects that feed on sweets; but the plant-lice do not feed on the honey-dew nor on sweets, as they draw all their living from the sap of the trees or plants that are infested. No one has ever seen plant-lice feeding on the sweet liquid called honey-dew; but, on the other hand, we have frequently observed this liquid coming from the cornicles or honey-tubes of plant-lice, as well as from the vent or digestive tract. No one can watch plant-lice during the summer without seeing the honey-dew appear first in small globules, and then increase to larger drops on the cornicles or honey-tubes, especially when ants are stroking the plant-lice with their antennæ. There can be no possible doubt about the source of this liquid.

As to whether the honey-dew is a benefit to the beekeeper depends upon how he winters his bees, and upon locality. If the bees can be wintered on their summer stands, or where they have flight as frequently as they need it, and the locality and season are such that they can fly frequently, say once every two or three weeks, they will winter all right on honey-dew; but if they are to be put into a cellar, or otherwise kept from flying for six weeks or two months, they will doubtless perish with dysentery. Honey-dew makes far more waste material to be voided from the system than any other food that the bees can take, and it is known that this voiding is done only when in flight. This explains why bees must be given an opportunity for flight if they are forced to feed on honey-dew. If such opportunity be not given, it is better to feed the bees abundantly as soon as possible with sugar syrup after having removed the honey-dew, and save this for stimulative feeding next spring.

THE UNPRECEDENTEDLY HEAVY YIELD OF HONEY-DEW DURING THE SUMMER OF 1909.

The year 1909 was remarkable for the immense quantities of honey-dew produced in almost every section of the country outside of the irrigated region where alfalfa and sweet clover are grown. In the eastern portions of the United States there was almost a failure of clear white clover or basswood. What little there was produced was so mixed with honey-dew that much of it was not suitable for table use.

Most of the honey-dew for 1909 came from the leaves of the hickory and oak. Contrary to what many have supposed, this saccharine matter found on the leaves came from aphides located higher up on the trees. But the ordinary observer not finding the insects, even after a search, might naturally conclude that they were not pres-

ent, and that the sweet, sticky, gummy stuff on the leaves was an actual exudation from the leaves themselves; but in every case a more careful and scientific search has shown somewhere the aphides.

Oddly enough, the honey-dew of 1909 made the bees unusually cross. They worked heavily on the dew during the early morning hours, and as soon as the sun dried the gummy substance down toward noon, so they could get no more of it, they became furious; in fact, they would act very much as if they had been robbing, and the supply of stolen sweets had suddenly given out. For further particulars regarding this, see ANGER OF BEES.

QUALITY OF HONEY-DEW.

Prof. A. J. Cook says that much of the honey-dew is "deliciously wholesome." While there are samples that are fairly palatable, the great majority of them, according to our experience, are dark and of very poor flavor, and in some cases positively nauseating. There is almost no market for them. Even the large baking concerns will not have them, for, as a matter of fact, they require good table honey, even though it be of very strong flavor.

We do not know what to do with honey-dew of poor quality but to hold it over and feed it out to the bees in the spring for stimulating brood-rearing—see FEEDING. It is not always safe to use as a winter food; but for raising bees it seems to be as good as the best honey known.

HONEY EXHIBITS, *and how they may be used in the development of the bee and honey industry.*—Of late, very much indeed has been accomplished by the exhibits of bees, honey, and apiarian implements at State and county fairs. Several of the larger societies have had very pretty buildings erected on the fairgrounds for these displays, and often the beekeepers here also have interesting conventions.

Such exhibits have a decidedly educational influence on the public. They show *how* honey is produced; and not only that, but that it can be produced by the ton and carload. On account of newspaper yarns, there seems to be a general impression among people that comb honey is manufactured, and that the extracted article is adulterated with glucose. It is absolutely impossible to manufacture comb, fill it with honey, and cap it over with appropriate machinery—just as impossible as it is to manufacture eggs. We have had for many years a standing offer of $1000 to any one who would show where comb honey was manufactured, or even procure a *single manufactured sample* which could not be told from the genuine. Although this offer has been published broadcast in the daily papers, no one takes it up. We have also had the conditions of this offer printed on a neat little card, the same distributed by beekeepers at fairs and other honey-exhibits, so that, if such a thing were possible, there would be a bonanza for somebody. As to extracted honey, there was a time when it was adulterated somewhat, but owing to the action of State and national laws there is very little of it now. See ADULTERATION OF HONEY, also the last paragraph on HONEY COMB.

Beekeepers, besides educating the general public as to the *genuineness* of their product, can create a larger demand for honey. As a usual thing, exhibitors are allowed to sell their honey, distribute circulars, and do a great deal of profitable advertising. This not only helps the individual, but helps the pursuit in general.

The following engravings will give an idea of how model exhibits should be arranged.

There should be shelving arranged in the form of pyramids, octagons, semicircles, etc. The honey should be put up in tin and glass, in large and small packages, and the whole should be neatly "set off" with appropriate labels. As a general thing, glass packages should have a very small label, so that as much of the liquid honey as possible will show. Tin receptacles should have labels to go clear around the can. Comb honey should be put up in cartons and shipping-cases; and yellow cakes of wax should be shown in a variety of shapes.

In one of the illustrations will be seen a large pyramid of beeswax, supporting on its several shelves packages of honey, the whole surmounted by the bust of a goddess. Make a series of square shallow boxes of such varied sizes that, when piled one on top of another, they form a perfect pyramid. These are to be completely covered with sheet wax having the edges that come

Suggestion for a beeswax exhibit at State fairs.

The apiarian exhibit at the Columbus State Fair, in September, 1906.

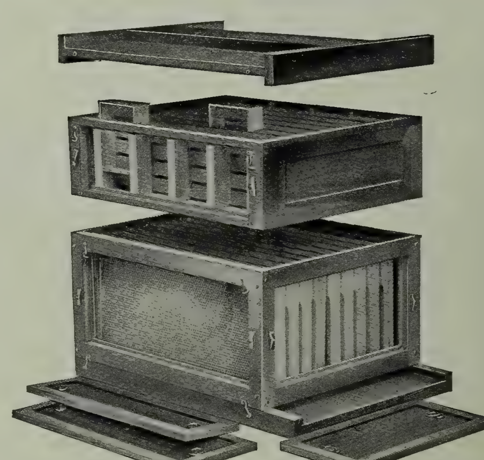
Exhibit of J. M. Buchanan, Franklin, Tenn., at Tennessee State Fair, Nashville, October 9, 1909.

in contact nicely cemented together with a hot iron. The letters are cut out of inch boards with a jigsaw, after which they are dipped in hot wax, and secured with nails to the pyramid. The next thing to make is the goddess of liberty, or the bust of a prominent man. These in plaster can usually be purchased at any of the stores for a small sum of money, and, after being dipped in hot wax, give a very fine wax figure.

A correspondent has suggested dipping a teddy bear in melted wax. It might muss up his fur a little, but he ought to look like a bear; and as this animal is known to be a connoisseur of good honey, his presence surmounting the pyramid would be very appropriate.

The bust of a woman on top of the pyramid, shown in the illustration, was made of plaster, and came with a box of soap. It struck the exhibitor that this would make a fine wax bust; and, as you will note, it shows up well.

Besides the exhibit of honey in various styles of packages, there should be a moderate collection of bee-supplies, so that, when the eager public come along with their string of questions, they can be shown step by step the process of producing honey and its final putting-up for market. A good many questions will be asked in regard to the extractor. It will be called a churn, a washing-machine, and every



Observation hive and combhoney super.

thing else except what it really is. And last, but not least important, there should be one or more observatory hives to show

Demonstration work at the Ohio State Fair, Columbus.

The A. I. Root Company's demonstrating-cage at the Medina County Fair.

folks how bees behave when at home. A good many will want to see the "king-bee." Tell them it is not a *king* but the *queen* that reigns.

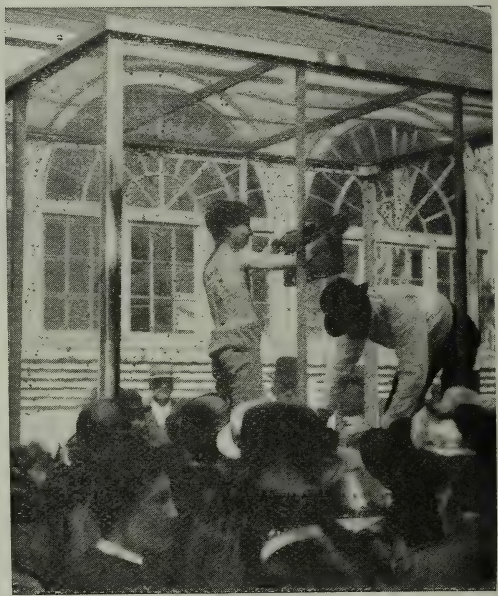
Very much can be done by having a glass hive and live bees, with an entrance communicating outdoors through the sides of the building where the exhibit is made. What is equally good, or perhaps better, is a one-frame nucleus having glass sides, making, as we call it, an observatory hive. This should contain one frame of nice healthy brood, regular and perfect comb, finely marked bees, and a bright-yellow queen. Hundreds of people will stop and examine, and ask a variety of questions about the bees and the queen. By this means one can convey to the consumer some knowledge of the habits of bees, and how honey is produced, thus indirectly creating a demand.

It should be stated in this connection that bees in an observatory hive will stand confinement for two or three days or even a week. Ordinarily at fairs and other places, where the show lasts only two or three days, the confined bees will do very well. But at expositions, where they are shown week after week, it is necessary to give them a flight every two or three days. Some arrangement should be made with the management by which these glass hives may be placed next to the wall of the building, the entrance communicating with a hole through the building.

The usual plan is to have two or three observatory hives, and keep one or two on exhibition all the time while the other is being freshened up by a flight outdoors. After these latter have had two or three days in which to cleanse themselves the entrance should be closed at night, when the hive can be put back on its stand, and another observatory hive take its place. So in alternation each one of the two or three lots of bees can be freshened up.

LIVE-BEE-DEMONSTRATION WORK TO ADVERTISE HONEY AT THE FAIRS.

In connection with an exhibit inside of the building, there should be a placard directing the visitor to a bee-show outside, as near the building as possible. This should be a demonstration of the method of handling live bees inside a wire cage, the operator taking them up by handfuls and forming artificial swarms. Where the two exhibits, one of honey and bee-supplies, and the bee-show itself, can be located outdoors, it will be better. The former should then be in a temporary booth or tent, since it would not do to have the exhibits of wax and comb honey exposed to the direct action of the sun. The bee-demonstrating cage should be located close by, within ten or twenty feet, and, as we have explained, it consists of a wire-cloth structure large enough to take in a man, a hive of bees, and leave room enough to practice ordinary bee-manipulation. This cage should be elevated on a stand four



Charles Mondeng and his son Norman demonstrating Adel bees at the Minnesota State fair. Mr. Mondeng and his son were awarded the first prize for bee demonstration; first prize on golden Italian bees; first prize on leather-colored Italian bees.

or five feet above the ground—the higher the better, because there will be a great jam of people around to see the man inside pick up live bees by the handful.

Announcement should be made from outside of the cage that, during certain hours, an operator, bareheaded and barearmed, will perform some wonderful stunts in handling bees. When the performance begins, the people will surge around the stands, and that is just what is desired in order to sell honey at the other stand a few feet away.

The operator begins his performance by stepping inside the cage of live bees, and

shutting the door behind him. He then tells the crowd that he is going to handle live bees, every one of which is armed with a sting; and if any one doubts it to come forward and he will furnish the "proof." He then proceeds to take off his coat and vest and roll up his sleeves, take off his

Norman Mondeng is only eleven years old, yet he handles bees without fear. His entire clothing was a bathing suit.

collar, and tuck down his shirt-band. It will then be necessary for him to put on bicycle pants-guards, or slip his trousers into his stockings. The crowd will quickly appreciate this part of the performance, because the operator tells them the bees will sting if they get inside of his clothing. With a lighted smoker he opens up the hive. After pulling out the frames he shows the bees and queen on the comb; then he calls out for everybody to wait and see the next stunt, for he is going to make a swarm. With a large dishpan, which he has previously provided, he shakes two-thirds of the bees off the combs into this pan. Then he takes it up and turns to the crowd, saying, "The bees are not real mad yet, so I'll begin to shake them up to make them so." The people wonder what he is going to do, seeing him barearmed and bareheaded. He keeps on shaking until he has the bees all in one big ball, and to the uninitiated it *looks* as if they would sting him to death. But, no! the continual shaking is the *very thing* that makes them gentle instead of cross. He now runs his hand under the ball of bees, pushing it under gently, being careful not to pinch any. The movement must be very deliberate—so slow indeed that the hand scarcely seems to move. He picks up a handful and holds them up for the crowd to look at. If he has good nerves he can put three or four bees in his mouth; shake a handful of bees on top of his head, and in the mean time pick up another handful.

At the next performance there will be big crowds around to see the work. While the man is doing his stunts with the bees he tells what honey is, saying that it is a

William H. Crowson demonstrating bees at the Tri-state Fair, Memphis, Tenn.

wholesome sweet, and that there is no such thing as manufactured comb honey, and that he will pay $100 for a single sample of it. At that psychological moment he draws attention to the fact that he has

The A. I. Root Company's exhibit at the Ohio State Fair.

some good honey at the stand opposite or in the building yonder. The crowd will then go round to the stand and buy the honey.

The preceding illustrations show the exhibits of bees and honey, the exhibit of the live-bee cage, and the crowd that assembled around it, both at the Ohio State Fair held at Columbus, and the Minnesota State Fair.

After the exhibitor gets his questioner interested, he can hand out one of his advertising cards, and at the same time give him a little sample of honey to taste. This can be done very readily by handing out some strips of strong manila paper, which are to be dipped in the honey and then transferred to the mouth.

HONEY-HOUSES.—See EXTRACTING-HOUSES.

HONEY ON COMMISSION.—See COMB HONEY.

HONEY-PEDDLING.—Under EXTRACTED HONEY, which see, we have already told something about selling direct to consumers. But there are many who say they "haven't the gall or cheek to go around and ask folks to buy," and prefer to be excused from any such disagreeable experience. But there are ways in which one does not need to lose either his dignity or self-respect. A peddler may, it is true, call at unseasonable hours, or steal valuable time from a prospective customer in trying to force a sale. In such ways one may make himself very obnoxious, and render a second visit utterly useless. Dan White of New London, Ohio, a progressive and practical beekeeper, has hit upon a novel plan that entirely eliminates all objectionable features. As he has succeeded so well we will let him tell his plan in his own way:

PEDDLING MADE EASY.

I packed my grip and took two 12-pound cans of honey and started out. About all I had in my grip was a good supply of those leaflets published by The A. I. Root Co.; also 50 postals addressed to myself.

I got into the town just before dinner time; and after eating a good meal at a boarding-house I filled my pockets with leaflets and took one honey-can and commenced business. I started down a street and did not miss calling at every house. After ringing the bell, or rapping, a lady would open the door and look at me with more or less suspicion. I would say, "I made the call to ask you if your family were fond of honey."

They generally answered yes, but believed they would not buy any.

"Well," I would answer, "but I am not selling honey to-day. I am giving it away, and should be glad to give you some in a sauce-dish."

Some would look astonished, others would smile, and say, "That's funny," but in *every* instance I was invited in. I would pour out the honey, then hand out a leaflet, telling them to read every word of it. "You will find it very interesting; it will tell you all about honey—how and why we extract it, etc. Then here is a postal addressed to me; and should you decide to want a 12-pound can, put your name, street, and number, on the card; drop it in

the office; and when I deliver in about ten days you will get a can of honey."

Well, there were enough cards put in the mail within five days to take thirty cans of honey. I promptly made the delivery on time, taking along twenty extra cans that sold about as fast as I could hand them out; and since then I have received orders for 50 more cans from the same town. I tell you, it has got all over town that a honey-man had been there selling *real* honey, 12 pounds for one dollar. I am certain that this one place will take over 2000 pounds, all in one-gallon cans. Now, then, 18 pounds of honey given away from house to house, 50 postal cards, 200 leaflets left at houses and handed to people on the street, and one day walking over a very small portion of the town, has found a place for at *least* 2000 pounds of honey. Then think what I can do next season should I secure a good crop. All I shall have to do is to take a big load and go up there and hand it out. By the way, the honey sold there was thrown out of clean white combs, over every inch of whose surface the uncapping knife had to go. It weighed strong 12 pounds to the gallon—just as good as the best comb honey, *only* it was out of the combs. Of *course*, I can go back just as often as I choose; yes, and the people will be glad to see me.

New London, Ohio. DAN WHITE.

It would appear that one of the prime requisites is a first-class article of well-ripened extracted honey. Very many make a mistake right here, and, of course, if the honey is poor, one is not likely to make a second sale. Mr. White's scheme is to have the honey taste *so good* that, when it is gone, the good people will drop that postal for more, and not haggle over the price, even if the "store stuff" does cost less.

In a similar way Mr. Herman F. Moore, then of Cleveland, O., now of Chicago, retailed large amounts of honey. His plan, like that of Mr. White, was to go around and solicit orders. In the cities of Cleveland and Toledo, or even those of smaller size, he would start out on foot, exhibiting a sample of his honey in a quart Mason fruit-jar. His reason for using this package was that almost any family would be willing to take a household article of this kind, for the simple reason that it would not have to be thrown away when it had served the purpose of holding the honey.

With this jar of honey Mr. Moore would call at private houses, one after another, and ask for a dish and spoon, saying that he had some very nice honey, and that he would like to give the women-folks a sample to taste. He then held up the beautiful transparent goods to the light, told them he was a beekeeper, and dealt only in pure honey; explained how it was produced, and finally named the price. If the lady of the house cared to take any he would take her order and deliver the next day. As a rule he took an order.

In this way he would make the rounds of a certain section of the city. When he first began he would take the orders one day and deliver the next; but his business grew so rapidly that he was finally obliged to take on a helper, his brother, and, a little later on, two more men and a man and his wife. The two last named would wash the jars and fill them. Two of the men would deliver while he and his brother took orders. In this way they sold enormous quantities of honey; and as it was always the finest quality, and guaranteed to be pure, they built up a large trade.

Here is another plan, providing one can trade honey for other useful articles too numerous to mention. Even if one did not sell much he would get a day of royal sport. Well, here is the Vinal plan:

TRADING HONEY FOR DUCKS, PIGS, PUPS, ETC.

In all the literature on bees and honey, we are urged to develop the home market. Acting on the advice, after I had traveled over my regular route this fall I went into an entirely new locality. After enjoying the scenery and the sunlight for about a five-mile drive I called at a farmhouse and inquired of the good lady if she would like some honey.

"Well, yes, I should like some, but I have no money."

Seeing some ducks, I offered to trade honey for ducks; and for a pair I gave four pint jars of honey.

Calling at another house, I sold $2.00 worth for cash; and while I was talking with the man one of the ducks gave a quack, which led to an inquiry as to what I had. I told them I had traded honey for ducks.

"Well, now, look here; can't I trade you some hens for honey?"

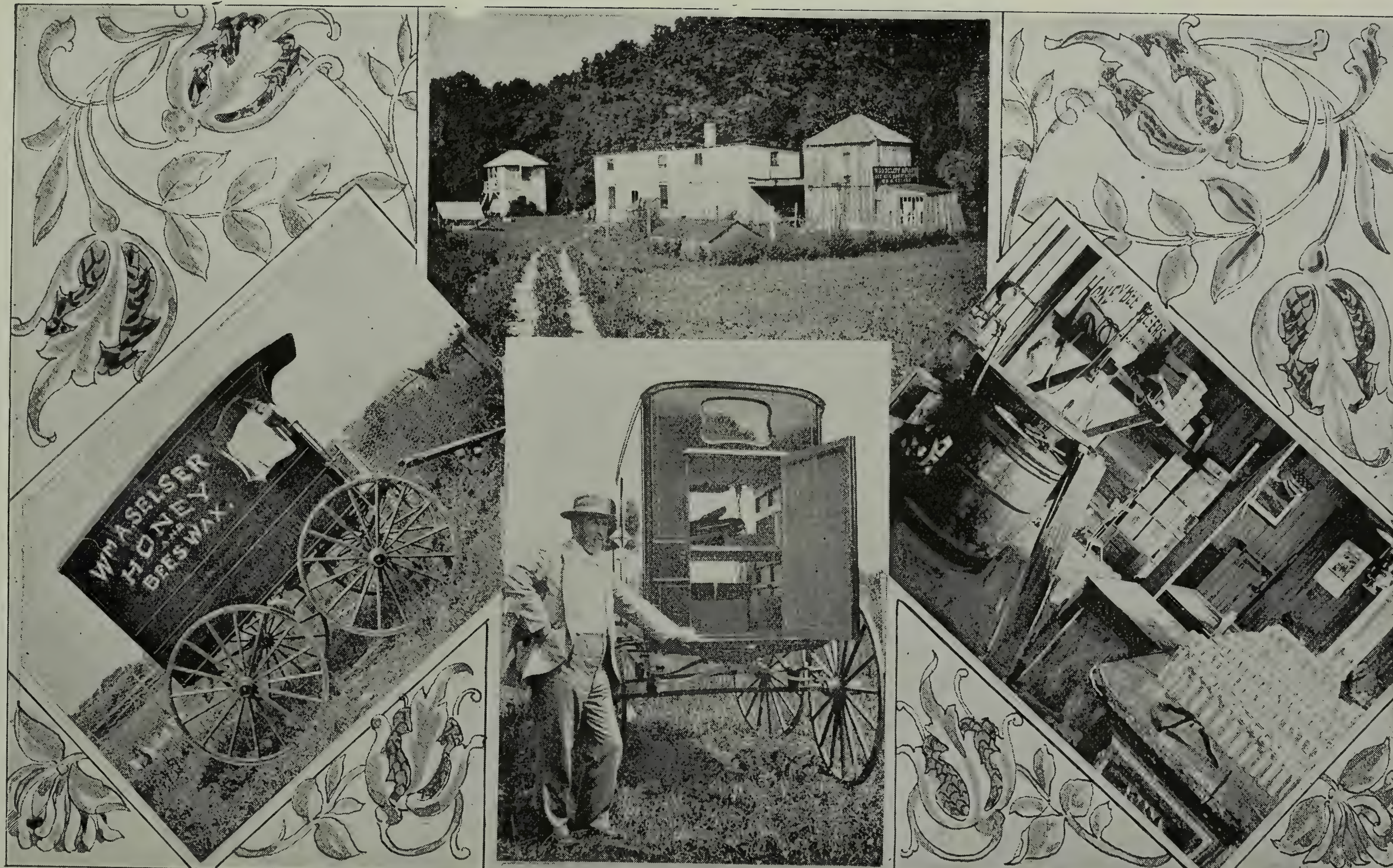
I traded for half a dozen, and made the children, I hope, happy (I was). In this way I passed the day, and on my drive home I was trying to figure out my profits. I had disposed of two gross of pint jars, and 120 pounds of comb honey. For the pint jars I received 25 cents; also 25 cents each for the sections of comb. I had had a royal day's sport: and as I listened to the quack of the ducks and geese, the cackle of the hens, and squeal of the pigs, and looked at the large box of eggs that I had in the wagon, I thought I would have to send for some of Dr. Mason's egg-preservative. After getting home I took account of stock. I had $54.40 cash, 108 dozen eggs, 8 ducks, 1 goose, 2 pigs, 24 hens, and 1 bullpup. (The pup is for sale.)

Charlton City, Mass. GEO. L. VINAL.

Another experience is thus given by G. C. Greiner, of La Salle, N. Y.:

Peddling honey has, like every thing else, its ups and downs. We don't always strike it rich. Some days it may seem like terribly steep uphill business, while other days the money may roll in by the handfuls. As an illustration, and a proof that the latter sentence is almost literally true, let me give you one day's experience.

Late last fall I chanced to take a trip to Niagara



Selser, his honey-peddling wagon, and his honey-bottling shop.

Falls with the intention of making a display of my goods at the city market. At first, things looked a little gloomy. Purchasers did not flock in as I had hoped, until after some minutes of patient waiting. One passing lady, in looking at my honey, asked, "Is your honey *pure?*" The reply I made must be imagined, for it would fill more space than the editor would be willing to allow. But let me emphasize—here is where the blabbing came in. In answering her question I delivered a good half-hour lecture in less than two minutes, trying to convince her of the purity, and all the good points of my honey. In the mean time, passing people had stopped to listen; and by the time my lady friend was ready to buy one of my quart cans I had quite a crowd around me. To cut the story short, for quite a few minutes I handed out cans, mostly quarts, as fast as I could make change (many of the purchasers promising to buy more the next time I attended the market, if the honey proved to be what I had recommended it to be.

When the market closed, at 11 A. M., I had a few cans left. With these I drove to Main Street and tied my horse in front of one of the stores, where I had a little business to transact. A few minutes later, while I was conversing with the storekeeper inside, some one opened the door and inquired:

"Hello! where is this honey-man?"

After introducing myself he requested me to show him what I had to sell. It did not take very long to convince him that I carried the genuine article; and what pleased me still more was the fact that he ordered two cans to be left at the corner drugstore across the steet.

When I delivered the cans they were closely scrutinized by the clerks and some other parties who happened to be present, and one of the clerks asked:

"What guarantee have we that this is pure honey?"

Here another lecture-like conversation, too long to be repeated, took place, the substance of which may be concentrated in my reply:

"First, pure honey and my name and address are on every package; and, second, back of this is the New York State law that prohibits all honey adulteration."

Before I left the place I sold two more cans to those other parties.

A great help in selling honey on the road is a proper traveling-outfit, which enables us to present our products in clean, neat, and inviting appearance. I know from experience that at least one-fourth of my sales of honey can be traced back directly to this feature.

PEDDLING HONEY AT GROCERIES AND OTHER RETAIL STORES.

Mr. W. A. Selser, of 10 Vine St., Philadelphia, is not only a practical beekeeper, but he was also a large buyer of honey. In addition to the amount he produced in his own apiaries, he bought up every year the product of several large yards. All of this, mostly extracted, he peddled out from a honey-wagon to the retail trade.

The secret of his success in selling and in getting good prices was in putting up always a first-class article in a neat and attractive form. He advertised liberally, and every one knew him about Philadelphia as "the honey-man."

After several gross, perhaps, were put up, Mr. Selser loaded all he could carry in a special wagon shown at the left, and in the central view at the bottom. He then visited the city stores and replenished their stock. After he had supplied all the city retail places he then went into the country, visited the suburban towns, and even drove as far as the city of New York, supplying some stores in that metropolis.

HONEY PLANTS.—The importance to American beekeepers of a thorough knowledge of the honey-producing flora of this country can not be overestimated. A beginning in this work has already been made by several States. An excellent preliminary list of Texan honey plants by Louis H. Scholl was published in 1908, and in 1911 there appeared a carefully prepared bulletin on the honey plants of California by M. C. Richter. In both these lists much attention is given to the geographical distribution within the State limits of the species enumerated. More or less complete lists of the chief mellifluous plants of Massachusetts, North Carolina, Nebraska, Oklahoma, and Arizona have also been prepared. So helpful have these publications been to beekeepers that there can be little doubt that similar bulletins will soon be issued by other States. Such investigations promise to bring to light many interesting and valuable facts. No one should enter extensively upon the production of honey without first investigating the flora on which he must depend for a marketable surplus. Success or failure may often depend upon such information.

The geographical distribution of honey plants in the United States presents many striking peculiarities. While some occur over the entire country, others are restricted to a small area. The sumacs extend from the Atlantic to the Pacific; so do the carrot and carpetweed, though the latter is commercially most valuable in central California. Sweet clover is spreading everywhere; and the goldenrods and asters know no north nor south. While heartsease grows throughout nearly all North America, the wild sunflower is confined chiefly to the West, cotton to the South, white clover to the East, and willowherb to the North. Much narrower are the limits of many other species. The white-tupelo region is a tract

of land along the Appalachicola River; manchineel occurs in the extreme south of Florida; the black mangrove in tide-water marshes in the southern half of the same State; our native acacias belong to Texas, the sages to southern California, and scores of other honey plants are equally restricted in their distribution. But it is not only in individual States that they are very variable in their range, but in almost every township; for example, within less than a mile of each other, yet without invading each other's territory, there may be found the salt-marsh goldenrod, the field goldenrod, and the wood goldenrod.

Honey plants are likewise very variable in the preference they exhibit for different soils. The tupelo and willows grow in wet swamps, the tickseed in marsh lands, the smooth sumac prefers a rocky soil, the mesquite and cacti are dwellers in the desert; the gallberries in Georgia avoid a limestone region, while sweet clover will grow nowhere else. The spikeweed and the alkaliweed thrive in an alkaline soil; the Rocky Mountain honey plant in a dry saline soil; the salt-marsh goldenrod in a soil and atmosphere impregnated with salt, while the fireweed springs up in profusion on burnt lands, and the production of nectar in wild alfalfa is greatly stimulated by a mountain fire.

Undoubtedly the secretion of nectar is often if not always correlated with the character of the soil, the temperature, and water supply. Alfalfa, which, in irrigated sections of California, is a large and most reliable yielder, is of little value along the coast or in the East. A heavy thundershower followed by a sudden fall in the temperature may bring a successful honey-flow from buckwheat or basswood to a premature end. Wild alfalfa may produce nectar abundantly on one side of the Coast Ranges, and very little on the other side. Heavy rains are likely to lessen greatly and light rains may either stimulate or retard the quantity of nectar secreted by a honey plant. The last honey obtained from lima beans and alfalfa is darker than the first. On a sandy soil the honey obtained from alfalfa is lighter in color than on a heavy soil, and lime in a soil is also reported to render a honey lighter. A prolonged drouth is apt to bring loss and disappointment, though it shortens the tubes of the red clover so that part of the nectar is available. Black sage requires a clear warm season preceded by abundant rain. Blue gum and red clover are very reliable yielders, and are largely independent of the weather.

Nor must the periodicity of honey plants be overlooked. The orange tree and the cabbage palmetto in Florida can be depended upon only about one year in three. Sage does its best one year in five, and is a partial failure every other year. The rules which govern the blooming of white clover have not yet been formulated. Manchineel does not afford a heavy flow every year. The different species also vary greatly in the length of time they are in bloom. In many cases they are in flower for only a few weeks; but carpet grass yields from May until frost; pepper bush from July to September; pin clover in California begins in February and continues through the summer, and alfalfa from April to October. Nor does candying take place at the same time in the different kinds of honey. After ten years white tupelo is still liquid, while the honey from blue curls granulates in the cells before they are sealed. Usually a honey granulates within six months after it is extracted.

Even where there is a good honey flora fair weather is essential, or the bees can not bring the nectar into the hive. The willows and the gallberries, which bloom in the spring when there is much rain and foggy weather, are, therefore, not so desirable as species which flower later. The succession of honey plants should also be considered. In California, after the orange trees have ceased to bloom for the rest of the season in that locality, the bees bring in only a "dribble" of dark honey from pepper and horehound. Fortunate is the beekeeper to whom the autumn months bring a heavy flow of nectar from fall flowers.

More information about the honey plants of foreign countries should be obtained. Who can say what happy surprises Africa, Asia, and the Pacific islands may yet afford the beekeeper? It should not be forgotten that sweet clover, alfalfa, pin clover, borage, eucalyptus, horehound, carrot, catnip, wild marjoram, thyme, and red, alsike, and crimson clovers are all introduced plants. Our agricultural and horticultural

explorers are successfully seeking new fruits, grains, and flowers; but do they ever look for new honey plants?

The possibilities of artificial pasturage are only partially recognized. In many localities the apiarist might greatly increase the number of nectariferous flowers by sowing each season a few pounds of sweet clover in waste places and along the roadside. There are many plants which produce paying crops, and are at the same time valuable to the apiarist, such as cotton, alfalfa, mustard, onions, lima beans, the orange, and a great variety of fodder plants and fruit trees. When it is remembered that more than one half of the principal honey plants of Florida are arboreal, and that many shade and timber trees yield nectar freely, there would seem to be good reason to expect that in the future forestry and bee culture may be united.

By hybridization and selection many new varieties of fruits and flowers have been originated; and the laws of heredity and breeding are studied more zealously to-day than ever before in the history of biology. Why should not plants, especially those valuable for fruits and seeds, be developed with a greater capability for secreting nectar? Insects have shown us what is possible in this direction. It is probable that there would have been very few nectar-producing flowers but for their agency. There may yet be an apple tree that, in addition to excellent fruit, will yield nectar as freely as does the orange or basswood. The orchardist of the next century may obtain a crop of honey from fruit bloom which will rival in value the later harvest of fruit. No effort has yet been made in this direction, and many of the achievements of the horticultural experimenter appear to have offered greater difficulties. There may yet be plants of which it may literally be said that they flow with nectar. The problems relating to honey plants are many, but as yet they have received but little attention.

POLLEN PLANTS.

An ample supply of pollen is of even greater importance to honeybees than large stores of honey. In limited areas nectar famines not infrequently occur, when in some localities, at least, the bees are able to obtain partial supplies from honey-dew, the sweet juices of broken or decayed fruits, and the sap of various plants. But there is nothing in nature which can be used as a substitute for pollen, though bees sometimes collect the spores of fungi and mosses to a small extent. Pollen famines do occur in Australia, according to R. Beuhne, when the brood dies in the hive, and no artificial substitute gives satisfactory results.

Of the true flowering plants called angiosperms, because they have their seeds enclosed in a seed-case, and receive the pollen on a prepared surface known as the stigma, there have been described in North America north of Mexico about 14,600 species. Of this number, at least 3000 are nectarless, but of necessity produce pollen. Very many of them have small green or dull-colored flowers, and are pollinated by the wind, as the alders, birches, poplars, elms, beeches, oaks, and hickories; the grasses, sedges, and rushes; many homely weeds like the pigweeds, ragweeds, nettles, pondweeds, sorrels, hemp, and meadow-rue. Usually the stamens and pistils are in separate flowers, which are borne on the same plant (monœcious), or on different plants (diœcious). They are commonly without nectar, since they depend on the wind for pollination; but they produce great quantities of pollen, and are consequently often valuable to the apiarist. See POLLEN.

Others are large handsome flowers like the roses and poppies, which are pollinated by insects, and are called pollen flowers; they contain no nectar, and insects visit them for pollen alone. Mistakes are often made in regard to these flowers, and bees are reported as bringing in nectar when such is not the case. Possibly some of these errors have arisen from the presence of honey-dew on the leaves. A list of the more important pollen plants is, therefore, given separately. No attempt has been made to include all nectarless flowers, but only those of importance to beekeepers. A great number of flowers yield both nectar and pollen; but these are placed under HONEY PLANTS. The species in the following list are nectarless unless otherwise stated.

PLANTS THAT YIELD POLLEN ONLY.

Alder (*Alnus*).—Wind-pollinated; the small brownish flowers appear in early spring. The aments (staminate) of the common or hoary alder (*A. incana*) are visited by honeybees for pollen.

Anemone (*Anemone quinquefolia*).—Large white pollen flowers; pollen gathered by bees in spring.

Ash (*Fraxinus*).—Some species are pollinated by insects, others by the wind; small greenish flowers.

Bayberry (*Myrica*).—Shrubs blooming in spring; flowers small, greenish, wind-pollinated.

Beech (*Fagus*).—Large trees, with small wind-pollinated flowers. Honey-dew is found on the leaves.

Birch (*Betula*).—Small greenish or golden-yellow flowers, appearing with or before the leaves in spring; wind-pollinated; mostly trees.

Bloodroot (*Sanguinaria canadensis*). — Large handsome white pollen flowers in April or May. Visited by honeybees in large numbers, which remove nearly all the pollen.

California poppy (*Eschscholtzia californica*).—Large orange-yellow pollen flowers; great numbers of bees visit them for pollen.

Castor-oil bean (*Ricinus communis*).—The small flowers are wind-pollinated; stamens very numerous; an abundance of pollen; extra-floral nectaries at the base of the leaves.

Chestnut (*Castanea*).—Flowers small, pale yellow, pleasantly scented, pollinated partly by the wind and partly by insects.

Clematis.—Mostly large handsome pollen flowers; yields honey also; cultivated forms visited occasionally by bees. Wild clematis (*C. virginiana*) yields a very little nectar, and is sometimes visited by bees, but is chiefly pollinated by flies.

Cockle-burr (*Xanthium canadense*).—Small flowers from which bees obtain pollen in the fall. They contain a little nectar.

Corn (*Zea mays*).—Wind-pollinated; bees gather pollen from the spindles; are reported to obtain sap from the stalks, but this should be confirmed.

Cone trees (*Coniferae*).—Fir, spruce, pine, cedar, juniper, and many other cone-trees. While they produce enormous quantities of pollen, it is not much used by bees—probably too resinous. From the folige of pine trees and spruces bees obtain much honey-dew. See HONEY-DEW. Gymnosperms.

Elder (*Sambucus*).—Small white pollen flowers in large clusters; bees sometimes gather the pollen.

Elm (*Ulmus americana*).—Small purple flowers which appear in the spring, and are wind-pollinated. They are visited by great numbers of bees for pollen.

Grape (*Vitis*).—Valuable for pollen; yield some nectar. Honey-dew occurs on the foliage.

Grasses (*Gramineae*).—Small greenish flowers, with a great abundance of pollen; wind-pollinated; sparingly visited by insects. About 429 species in North America.

Hazelnut (*Corylus americana*).—Small yellowish flowers, valuable for pollen in early spring; wind-pollinated.

Hepatica (*Hepatica triloba*).—Handsome blue or white pollen flowers; attractive to bees in early spring.

Hemp (*Cannabis sativa*).—Small flowers pollinated by the wind.

Hickory (*Carya*).—Pecan, mocker-nut; large trees with small wind-pollinated flowers; valuable for pollen; much honey-dew on the leaves.

Hop (*Humulus lupulus*).—Small greenish flowers, wind-pollinated; common.

Hornbeam (*Carpinus caroliniana*).—Large tree, with small wind-pollinated flowers.

Loosestrife (*Lysimachia vulgaris*).—Medium-sized yellow pollen flowers.

Lupine (*Lupinus*).—The flowers are nectarless, but are frequently visited by honeybees and other bees for pollen. Honeybees sometimes vainly attempt to suck nectar from the flowers. Blue lupine (*L. subcarnosus*) is very abundant in Texas, and is often visited by bees for pollen. It is reported to yield nectar. If this is correct the species is exceptional.

Meadow-rue (*Thalictrum*).—Common; white or greenish pollen flowers visited by honeybees for pollen. Rue anemone (*Anemonella thalictroides*) produces a great abundance of white flowers in low land; wind-pollinated.

Mullein (*Verbascum*).—Common; bright-yellow pollen flowers. A part of the species are nectarless. Others contain some nectar.

Mulberry (*Morus rubra*).—A tree with small wind-pollinated flowers.

Nettle (*Urtica*).—Greenish flowers in summer; wind-pollinated.

Oak (*Quercus*).—Small greenish or reddish flowers; wind-pollinated. Honey-dew is found on the foliage of many species.

Pigweed (*Chenopodium*).—Goosefoot. White mealy garden weeds, with small greenish sessile flowers in large clusters, wind-pollinated. Also amaranth; also called pigweed (*Amaranthus retroflexus*); coarse wind-pollinated weeds in cultivated ground; flowers in large clusters, of some value for pollen.

Poppy (*Papaver*).—The poppies are very large showy pollen flowers visited by honeybees. The scarlet color does not repel bees, as has been reported.

Plantain (*Plantago*).—Partly pollinated by the wind and partly by insects; flowers contain a little nectar, and have a pleasant odor; very common weeds, visited by honeybees.

Poplar (*Populus*).—Aspens. Small purplish flowers, wind-pollinated; pollen abundant, forcibly expelled from the anthers; said to be valuable; nectar-glands at base of leaf-stalks. Honey-dew sometimes occurs on the foliage. It should be distinguished from the white poplar (*Liriodendron tulipifera*).

Prickly poppy (*Argemone*).—Large yellow or while pollen flowers. *A. platyceras* in Texas blooms in June, and honeybees gather large quantities of its pollen.

Ragweed (*Ambrosia*).—Small green flowers pollinated by the wind; valuable in the fall for their abundant supply of pollen. Two common species are Roman wormwood (*A. artemisiaefolia*) and great ragweed (*A. trifida*).

Rockrose (*Helianthemum canadense*).—Large, solitary, yellow pollen flowers; common in the Eastern States.

Roses (*Rosa*).—These handsome well-known flowers are nectarless, but yield much pollen which is gathered by honeybees and many wild bees.

Rushes (*Juncaceae*).—Small green lily-like flowers; wind-pollinated.

St. John's-wort (*Hypericum*).—Small yellow pollen flowers; common; attractive to bees after pollen.

Sedges (*Cyperaceae*).—A large family of grass-like plants; flowers small, green, wind-pollinated. The so-called "tule honey" has been reported to be gathered from species of scirpus growing along the Sacramento River, California; but this is undoubtedly a mistake.

Sorghum (*Sorghum vulgare*).—Pollen very abundant; a grass.

Tick-trefoil (*Desmodium*).—Flowers resemble those of the field-pea, or vetch; many species are nectarless, and do not appear to be visited by honeybees, though the pollen is gathered by bumblebees. Sometimes listed as honey plants.

Walnut (*Juglans*).—Large trees with small wind-pollinated flowers. Valuable for stimulating early brood-rearing in the spring.

Many handsome garden exotics, as pelargonium and hybrid petunias, are nectarless.

PLANTS THAT YIELD NECTAR.

A honey plant may be defined as a plant which secretes nectar accessible to honeybees, in quantities sufficiently large to be of practical importance to beekeepers. This, of course, implies that in some locality it is a common plant. If a list of all plants secreting nectar were desired, it would be easy to enumerate thousands of species;

but very few of them are of practical importance in bee culture. Many are rare, others grow in the deep recesses of forests and swamps, while still others yield so little nectar that the larger bees pass them by unheeded. The bunchberry (*Cornus canadensis*) is very common in open woodlands; but the small flowers contain so little nectar that bumblebees ignore them entirely, and honeybees visit them only occasionally. They are left to flies, beetles, and the smaller bees. Then there are many flowers adapted to moths, butterflies, bumblebees, and hummingbirds, which have the nectar so deeply concealed that it can not be reached by honeybees. Many a beginner in beekeeping has fondly imagined that his flower garden would supply his bees with a rich harvest, wholly unconscious that the gaudy exotics of cultivation are often nearly or quite nectarless. In the following list the more important honey plants in North America, so far as known at present, either wild or cultivated, have been briefly described.

Acacia.—A large genus of shrubs and trees, most abundant in Australia; honey white, of fine quality. The most important species in this country are *A. Greggii,* southeast Texas, New Mexico, and Arizona—see CATCLAW; *A. Berlandiera,* along the Rio Grande—see HUAJILLA; *A. Farnesia* (*huisache*), along the lower Rio Grande and Gulf Coast; *A. Roemeriana,* southern Texas; *A. dealbeata* (silver wattle), and *A. decurrens mollis* (black wattle) in California.

Agave.—See CENTURY PLANT.

Alfilarila.—See PIN CLOVER.

Alfalfa (*Medicago sativa*).—One of the most valuable honey plants in irrigated regions of the West; honey water-white to amber; thick, and of superior quality.—See ALFALFA.

Alsike.—See CLOVER.

Andromeda.—Shrubs, in northern Florida yielding a reddish-yellow pungent honey.

Apple (*Pyrus malus*).—Often yields a small surplus; honey light in color and of good quality. Crabapple (*P. coronaria*) is also of value.

Apricot (*Prunus armeniaca*).—A small yield of honey.

Asters (*Aster*).—Common fall flowers; honey medium in quality and color.—See ASTER.

Artichoke, globe (*Cynara scolymus*). — Freely visited by bees, but honey unknown. Cardoon (*C. cardunculus*) is very common in Argentina.

Artichoke, Jerusalem (*Helianthus tuberosa*).—A good honey plant, cultivated for tubers.

Banana (*Musa sapientum* and *Musa ensete*).—The flowers produce large quantities of pollen and nectar. Cultivated in Florida.

Barberry (*Berberis vulgaris,* Eastern States; *B. pinnata,* Cal.; *B. trifoliata,* Texas).—Shrubs yielding both pollen and nectar; honey amber-colored, sometimes a surplus.

Basil (*Pycnanthemum virginianum*).—Mountain mint; Minnesota to Georgia and Alabama. Bees visit it freely.

Basswood (*Tilia americana* and *T. heterophylla*).—Among the most valuable honey plants of North America; a white honey with an aromatic flavor. Central-Northern States, and as far south as Texas. The European basswood, or linden, is equally valuable, and is widely planted as an avenue tree.—See BASSWOOD.

Beans, lima (*Phaseolus lunatus*).—From lima beans in California there is obtained a thick water-white honey of delicious flavor. Horse-beans (*P. nanus*) in British Isles and Holland are also valuable.

Bearberry (*Arctostaphylos*).—Gives a surplus in parts of California. In Placer County, according to *Gleanings in Bee Culture,* it is the best honey-yielder; blooms in December; honey amber-colored, of fine flavor.

Bee balm (*Melissa officinalis*).—In gardens, sparingly wild.

Beggar-ticks (*Bidens frondosa*).—Commonly listed, but value as a honey plant not certainly known.

Bellflower (*Epomoea sidaefolia*).—Christmas bells, Christmas pop, campanilla. Honey pearly white, equal to alfalfa in flavor. Mexico, Cuba, and Jamaica.—See CAMPANILLA.

Blackberry (*Rubus*).—Many species throughout the entire country; flowers yield both pollen and nectar in moderation; honey of good quality.

Black gum.—See TUPELO.

Blue Curls (*Trichostema lanceolatum*).—A white honey that granulates very quickly, often before it is sealed.

Black mangrove (*Avicennia nitida*).—Tide-water marshes on the east and west coasts of southern Florida and on the Keys; honey very white, of mild flavor, equal to that of orange or palmetto.

Blackheart, or water smartweed (*Polygonum acre*).—In wet lands in Illinois and southward. For other species see HEARTSEASE.

Black haw (*Viburnum prunifolium*).—Of value for early brood-rearing.

Blue lupine (*Lupinus subcarnosus*).—Blue-bonnet. In Texas it carpets the fields with blue; very frequently visited by bees for orange pollen; reported to yield nectar, but this should be confirmed, as the lupines are nectarless.—See LUPINE under POLLEN PLANTS.

Blueweed (*Echium vulgare*).—Viper's bugloss. Showy bright-blue flowers, very frequently visited by bees. A weed from Europe, common in places.

Bokhara.—See SWEET CLOVER.

Boneset, or thoroughwort (*Eupatorium perfoliatum*).—A honey plant of considerable importance.

Borage (*Bordgo officinalis*).—Cultivated from Europe, an excellent honey plant .

Box-elder (*Acer negundo*).—Manitoba to Texas. The small greenish flowers yield nectar.

Buckeye (*Aesculus glabra*).—Ohio to Kansas and southward. Considerable honey is obtained from the California buckeye (*Aesculus californica*).

Buckthorn (*Rhamnus cathartica*).—This species is found in the middle States. *Cascara sagrada* (*R. Purshiana*), according to *Gleanings in Bee Culture,* is the main honey plant at Sonora, Cal. Comb honey from this plant is so dark that it sells poorly where not known, but is highly valued for its medicinal properties; does not granulate; a profusion of flowers on which the bees work for about twenty-five days. The coffee-berry (*R. californica*) yields a heavy amber honey.

Buckwheat (*Fagopyrum esculentum*).—A dark purplish honey of heavy body. Extensively grown in New York and Pennsylvania.—See BUCKWHEAT.

Buckwheat, wild (*Eriogonum fasciculatum*).—In parts of southern California the most important honey plant; honey light amber, of good flavor; granulates.

Burr clover (*Medicago denticulata*).—Closely related to alfalfa. Common in California; occasionally yields a surplus.

Button-bush (*Cephalanthus occidentalis*).—Important on the overflowed lands of the Mississippi, and in swamps in other States. A mild light-colored honey.

Buttonweed (*Senecio glabellus*).—Several species of *Senecio,* or groundsel, appear to be of value as honey plants.

Cabbage (*Brassica oleracea*).—Cabbage, rape, turnip, radish, cress, horseradish, mustard, and

many other species of the mustard family (*Cruciferae*) are of value.—See MUSTARD.

Cactus, or prickly pear (*Opuntia Engelmannii*).—Southwestern Texas, and southward and westward. Sometimes a surplus of honey, of light-amber color; body heavy and "stringy," of rank flavor; flowers yellow inside, red outside.

Campanilla.—See BELLFLOWER and CAMPANILLA.

Canada thistle (*Cirsium arvense*).—A common weed from Europe; honey of good color and quality.

Carpet grass (*Lippia nodiflora*).—One of the principal honey plants of central California, also valuable in the West Indies; honey light-colored, of mild flavor. *L. lanceolata* and *L. repens* are likewise much visited by bees, but are less important.—See CARPET GRASS.

Carrot (*Daucus carota*).—From Maine to California, naturalized from Europe. A white honey; candies in a few months.

Cascara sagrada.—See BUCKTHORN.

Cassia.—The species of cassia are largely pollen flowers—that is, they are nectarless. This is not the case with the partridge pea (*Cassia chamaecrista*), one of the greatest yielders of nectar in Georgia and Florida, and wild senna (*Cassia marylandica*). In northern Florida the woods for miles is yellow with the blossoms of the sensitive pea (*Chamaecrista fasciculata*), which belongs to the closely allied genus *Chamaecrista*; the honey is light amber and very clear, thin body, and rather strong in flavor. In rainy seasons the quality is inferior, and the quantity small. Blooms from July to mid-September.

Catalpa (*Catalpa speciosa*).—Not important; honey of medium quality; a handsome shade tree. —See CATALPA.

Catclaw.—See ACACIA and CATCLAW.

Catnip *Nepeta cataria*).—Secretes nectar very freely under cultivation.—See CATNIP.

Century plant (*Agave americana*).—Cultivated; yields nectar copiously.—See CENTURY PLANT.

Cherry (*Prunus*).—The cherries, of which there are many species, yield nectar quite freely.

Christmas berry (*Heteromeles arbutifolia*).—Common in the Coast ranges of California; honey amber-colored, thick, candying in a few months; often a surplus.

Clover, white (*Trifolium repens*).—The most important honey plant in the eastern and central States; honey white, of the finest quality. A part of the nectar of the red clover is available in dry seasons (*T. pratense*). The honey of alsike clover (*T. hybridum*) is equal to that of white clover, as is also that of crimson clover (*T. incarnatum*). The yellow clovers are of much less importance. Sour clover (*T. fucatum*) is the source of considerable honey in the alkaline regions of central California.—See CLOVER.

Clover.—See SWEET CLOVER, SANFOIN CLOVER, PIN CLOVER, JACKASS CLOVER, and BURR CLOVER.

Cotton (*Gossipium herbaceum*).—Important in the cotton belt; honey light, of fair quality, not equal to that of white clover.—See COTTON.

Cow pea (*Vigna sinensis*).—From China, widely cultivated for forage. In Georgia it is under cultivation in all parts of the State, blooming from June to September; but it yields a surplus in few places; honey light-colored, but of inferior flavor.

Cucumber (*Cucumis sativus*).—In the vicinity of pickle-factories this plant yields quite a harvest of honey after clover is over. Poor flavor.

Currant (*Ribes*).—The many species of currants and gooseberries, both wild and cultivated, are widely distributed and are of some value.

Coral berry (*Symphoricarpos orbiculatus*).—Indian currant. New Jersey to Texas. Yields considerable nectar, and blooms for a long time.

Cow itch (*Cissus incisa*).—A vine growing on sandy shores from Florida to Texas. Sometimes there is a small surplus of honey.

Crownbeard (*Verbesina virginica*). — Pennsylvania to Texas. The white flowers appear in the fall, and are the source of much honey of fine quality.

Dandelion (*Taraxicum officinale*). — Eurasia, North America, and many other parts of the world. Valuable in spring for both pollen and nectar.

Eryngo (*Eryngium articulatum*).—A dark honey of good flavor. California.

Eucalyptus.—A genus embracing many species of trees which are a very important source of honey in Australia; many species have been introduced into California. Blue gum (*E. globulus*) and *E. leucoxylon, melliodora, phaceafolia,* and *robusta* yield a great abundance of nectar. The honey varies from waterwhite to amber, and from a most agreeable to a peculiar acid taste in blue gum, which renders it unsalable at retail.

False indigo (*Amorpha fruticosa*).—Ohio southward to Florida. Not important.

Figwort (*Scrophularia*).—The figworts would be excellent honey plants if they were more common. The Simpson honey plant (*Scrophularia vernalis*) has been cultivated and very highly praised. In the eastern States *S. marylandica* and in the western *S. californica* are freely visited by the honeybees.

Furze (*Ilex europaeus*).—Belongs to the pulse family; introduced from Europe; a good honey plant.

Gallberry (*Ilex glabra*).—Georgia and other southern States. A reliable yielder; honey white, of superior quality; also several other species. See HOLLY and GALLBERRY.

Germander (*Teucrium canadense*). — Central States. Honeybees common on the flowers.

Giant hyssop (*Agastache nepetoides*).—Vermont to Nebraska and southward. In bloom about six weeks; many honeybees.

Golden honey plant (*Actinomeris squarrosa*).

Goldenrod (*Solidago*).—Numerous species. Surplus in New England; honey golden or dark amber; thick, of fine flavor.

Gooseberry.—See CURRANT.

Greasewood (*Adenostema fasciculatum*).—In dry saline localities in the West; frequently visited by bees.

Hawthorn (*Crataegus*).—A great number of closely allied species, blooming in May; valuable for both nectar and pollen.

Heather (*Calluna vulgaris*).—Locally on the eastern coast; a prolific source of honey in Europe and the British Isles; honey rich amber, of pronounced flavor and pungent aroma.

Hedge nettle (*Stachys*).—Many species secrete nectar freely, and attract a large number of bees.

Horsemint (*Monarda punctata*).—New York to Florida and Texas. One of the main yielders in Texas; honey of good quality, but rather strong-flavored. Wild bergamot (*M. fistulosa*) is also valuable. *M. clinopodioides* is likewise very valuable; honey has been compared to that of basswood. See HORSEMINT.

Heartsease (*Polygonum persicaria*).—Naturalized from Europe throughout a large part of North America; honey varies from light to dark amber; flavor very good. Water smartweed (*P. punctatum*) occurs in wet lands throughout North America; honey dark, and of poor quality. Many other smartweeds are of more or less value; about 70 species in North America. See HEARTSEASE.

Hop tree (*Ptelea trifoliata*).—Florida to Texas and northward; nectar abundant; honeybees common.

Horehound (*Marrubium vulgare*).—Good yields of dark honey, but it is so bitter as to be almost worthless except for medicine.

Holly (*Ilex*).—Common or American holly (*I. opaca*) and white holly (*I. myrtifolia*) are eagerly visited by bees in Georgia; and the honey, though not obtained unmixed, is regarded as excellent. The gallberries belong to the same genus. See GALLBERRY.

Honeysuckle (*Lonicera*).—Honeybees suck the nectar in the flowers of several species of bush honeysuckle, as Sullivant's honeysuckle (*L. Sullivantii*). The nectar of the climbing garden honeysuckle (*L. periclymenum*), adapted to moth, and of the trumpet honeysuckle (*L. sempervirens*), adapted to hummingbirds, is beyond the reach of hive-bees.

Horsechestnut (*Aesculus hippocastanum*). — Adapted to bumblebees; but honeybees obtain both pollen and nectar.

Honey locust (*Gleditschia triacanthos*).—Flowers rich in nectar. See LOCUST.

Huajilla.—See ACACIA and GUAJILLA.

Jackass clover (*Wislisenia refracta*).—A most promising honey plant, rapidly spreading in California. Blooms in the fall; honey white, mild; a large surplus.

Judas tree (*Cercis canadensis*).—Redbud. From the red-purple flowers honeybees gather both nectar and pollen.

Knotweed.—See HEARTSEASE.

Lemon (*Citrus limon* L., or *C. limonium* Rossi). Valuable for honey in San Diego Co., California.

Linden.—See BASSWOOD.

Locust, common or black (*Robinia pseudo-acacia*). Widely planted; blooms in May; honey white; a surplus. See LOCUST.

Logwood (*Haematoxylon campechianum*).—Common in the States bordering on the Bay of Campeche; introduced into Florida, Jamaica, and in the West Indies; honey nearly water-white, of good body, and unexcelled in flavor and aroma. See LOGWOOD.

Loquat (*Eriobotyra japonica*).—Sometimes wrongly named Japan plum; south and in California; valuable because it flowers late.

Lucerne.—See ALFALFA.

Modrona (*Arbutus Menziesii*).—Nectar and pollen.

Magnolia.—Trees with very large white flowers; not very important.

Mallow (*Malva*).—The flowers of several species are very frequently visited by honeybees for nectar and pollen, but not important except perhaps locally.

Manchineel (*Hippomane mancinella*).—Southeast Florida and on the Keys. Nectar very abundant. Small trees with apetalous, greenish flowers.

Maples (*Acer*).—The different species are of much value, yielding both nectar and pollen for early brood-rearing. The sugar maple (*Acer saccharum* Marsh) produces a profusion of flowers.

Marigold (*Gaillardia pulchella*).—One of the main honey-producing plants of Texas. Honey rich golden, and of good quality. See MARIGOLD.

Marjoram (*Origanum vulgare*).—Introduced from Europe; in gardens, and sparingly escaped. A favorite of honeybees, but not common enough to be of much value.

Meadow-sweet (*Spiraea salicifolia*).—Very abundant; the most frequent visitors are flies; not important.

Melilot.—See SWEET CLOVER.

Melons (*Cucumis melo*).—Melons of all kinds are valuable to apiarists.

Mesquite (*Prosopis juliflora*).—Southwest in semi-arid regions. Main source of honey in Texas; a white honey of good quality. See MESQUITE.

Milkweed (*Asclepias*).—Honeybees visit many species for nectar, but the pollen-masses often become attached by dry membranous clips (*corpuscula*) to their claws or tongues; sometimes they are unable to extract the pollinia, and finally perish; dead bees are often found on the flowers. See MILKWEED.

Mayweed (*Antemis Cotula*).—Honey light yellow, and very bitter.

Milk-vetch (*Astragalus*).—The various species are visited by honeybees, and the more common are valuable in favorable seasons.

Mint (*Mentha*).—Honey amber-colored.

Mistletoe (*Phorodendron flavescens*). — Yields nectar and pollen; valuable in Texas for early brood-rearing; blooms in January and February.

Mustard (*Brassica*).—Honey light, or mild flavor; not as heavy as alfalfa; candies quickly; a large surplus in Lompoc Valley, California. See MUSTARD.

New Zealand flax (*Phorium tenax*).—Sometimes grown in the South; covers thousands of acres in New Zealand; a valuable honey plant.

Onion (*Allium cepa*).—Surplus yields of honey are obtained from fields of onions cultivated for seed; the peculiar onion odor and flavor disappear as the honey ripens.

Orange (*Citrus aurantium*).—Yields a surplus in Florida and California. Honey nearly transparent, of delicious flavor, with the aroma of the blossom; candies after a few months. See ORANGE.

Palmetto (*Sabal palmetto*).—Southern half of Florida; honey waterwhite, very mild; but not as fine as that from saw palmetto. Saw palmetto (*Seranoa serratula*) grows in the hummock lands throughout Florida; honey lemon-yellow, thick, of the finest flavor, and seldom candies. See PALMETTO.

Partridge pea.—See CASSIA.

Peach (*Prunus persica*).—Sometimes a small surplus.

Pepperidge.—See TUPELO.

Pear (*Pyrus communis*).—Yields nectar more abundantly than does the apple, sometimes a surplus. See FRUIT BLOOM.

Pepper tree (*Schinus molle*).—California and Florida; honey amber-colored, and of pronounced flavor. See PEPPER TREE.

Pepper bush (*Clethra alnifolia*).—White alder. On the coastal plain of Georgia and in northern Florida it yields a surplus; honey white and of superior quality; blooms from June to October.*

Pepper vine.—See SNOWVINE.

Pennyroyal (*Hedeoma pulegioides*).—A small surplus in the southern half of Florida, where it blooms in January; honey is clear, and of good flavor and body.

Persimmon (*Diospyrus virginianum*).—Connecticut to Florida and Texas. A large tree; blooms in spring; valuable.

Phacelia.—At Ventura, California, a water-white honey is obtained from *Phacelia hispida;* it has a fine flavor, but candies soon after extracting. In central California *P. tanacetifolia* yields a mild light-amber honey. See PHACELIA.

Pigeon cherry (*Prunus pennsylvanica*).—Considerable nectar is obtained from the flowers.

Pin clover, or alfilarila (*Erodium cicutarium*).—Maine to Texas and California, but most abundant in the West; honey of good quality and flavor. *E. moschatum* is also a valuable honey plant; honey similar to that of the preceding species.

Plums and prunes (*Prunus*).—All kinds of plums yield nectar.

Prairie clover (*Petalostemum candidum*).—Belongs to the pea or pulse family; reported as valuable.

Pumpkin (*Cucurbita pepo*).—Cultivated; honey amber-colored; candies quickly.

Raspberry (*Rubus idaeus*, variety *aculeatissimus*).—Very common in northern Michigan; a white honey of the finest flavor. See RASPBERRY.

Rattan (*Berchemia scandens*).—In Texas, in favorable seasons, yields a surplus of dark-amber honey used for manufacturing purposes.

Redbay (*Persea borbonnia*).—A southern tree with small yellowish flowers growing near the coast.

Redbud.—See JUDAS TREE.

Red gum (*Eucalyptus rostrata*).—Nectar abundant; a promising species. See EUCALYPTUS.

Rhododendron and kalmia.—The flame-colored azalea (*Rhododendron calendulaceum*) and the mountain laurel (*Kalmia latifolia*) when in bloom in the mountains of North Carolina give a distinctive color to the landscape. The honey has been reported to cause nausea and dizziness. See POISONOUS HONEY.

Rocky Mountain bee plant (*Cleome serrulata*).—Very attractive to bees; handsome rose-colored flowers. See ROCKY MOUNTAIN BEE PLANT; also SPIDER PLANT.

Rose apple (*Eugenia jambos*).—Very important in Cuba and Porto Rico.

Sage (*Salvia*).—Black or button sage (*S. mellifera*) is one of the chief honey plants of California; honey thick, white, of delicious flavor, not inclined to candy. Purple or white-leaved sage (*Salvia leu-*

* This plant is from Canada south, and yields heavily in New England. In Rhode Island it flowers from mid-July to September.

cophylla) yields a similar honey, but is less abundant. White sage (*S. apiana*), though one of the commonest species, does not yield nectar as freely as the two above-named species, but the honey is equally good. Creeping sage (*S. sonomensis*) is common in the mountains and Sierra foothills; honey of about the same quality as black sage. Annual sage (*S. Columbariae*) yields a surplus of excellent honey in Monterey County, Cal. The lance-leaved sage (*S. lanceolata*) is listed as a honey plant in Nebraska, and the blue sage (*S. azurea*) in Texas. Many species of sage are adapted to bumblebees, or in South America to honey-sucking birds, but the nectar can not be obtained by honeybees. See SAGE.

Sainfoin clover (*Onobrychis sativa*).—Cultivated for hay or fodder. Honey resembles that of white clover. See SAINFOIN CLOVER.

Sensitive pea.—See CASSIA.

Serradella clover (*Ornithopus sativus*).—A fine honey plant, similar to sainfoin.

Shadbush (*Amelanchier canadensis*).—Honeybees gather both nectar and pollen; of minor importance.

Simpson's honey plant (*Scrophularia vernalis.*)—Cultivated; a great favorite of bees. See FIGWORT.

Smartweed.—See HEARTSEASE.

Sneezeweed (*Helenium autumnale*).—Swamp sunflower; in wet land throughout the eastern States. Honeybees suck nectar and gather pollen. In Texas, bitterweeed (*H. tenuifolium*) yields a golden-yellow honey of heavy body, but very bitter, "as if 50 per cent quinine and some pepper were added."

Sourwood (*Oxydendron arboreum*).—A splendid honey-producer. The nectar is so abundant that it can be shaken from the blossoms; a superior honey which does not readily candy. See SOURWOOD.

Sow thistle (*Sonchus oleraceus*).—In waste places; yields some nectar.

Spanish bayonet (*Yucca*).—Honeybees suck the nectar of *Y. filamentosa* and of *Y. Whipplei*, and the latter is said sometimes to yield a surplus.

Spanish needles (*Bidens aristosa*).—Marshy lands of Mississippi and Illinois Rivers; honey golden, of exquisite flavor, and good body; not inclined to granulate.

Spider plant (*Cleome spinosa*, formerly called *C. pungens*).—Introduced from tropical America; cultivated; escaped in waste places from Illinois to Louisiana. Thirteen flowers have yielded a spoonful of nectar. "Under favorable conditions one of the most remarkable honey plants in the world." The Rocky Mountain bee plant (*C. serrulata*, formerly called *C. integrifolia*) grows in dry saline soil from Minnesota to Kansas, and westward among the mountains.

Spikeweed (*Centromadia pungens*).—"On the alkaline plains of the upper San Joaquin (Cal.) this species covers tens of thousands of acres; honey amber, of good color, but granulates quickly."

Squash (*Cucurbita maxima*).—Nectar abundant in a little reservoir at the bottom of the flower.

Sumac (*Rhus glabra*).—New England and southwestward. A surplus in Connecticut; honey bright amber; very heavy, but at first has a bitter odor and flavor which disappear as it ripens: waxes instead of granulating. Mountain sumac (*R. copallina*) yields a surplus in Georgia and Texas. *R. diversiloba* is common throughout California. See SUMAC.

Sunflower (*Helianthus annuus*).—Common wild in the West; yields a surplus of amber-colored honey with a characteristic flavor.

Sweet clover (*Melilotus alba* and *M. officinalis.*—Introduced from Europe; white and yellow sweet clover are spreading throughout the entire country. Honey white with a slight greenish cast, hardly equal to white clover. See SWEET CLOVER.

Snowvine (*Cissus arborea*), pepper vine.—In wet land, Virginia and southward. In southern Georgia it blooms from June to September; honeybees give it the preference to cotton. Honey not as light-colored as that of cotton, but of fair quality.

Sweet fennel (*Foeniculum vulgare*).—Cultivated from Europe, and escaped in waste land. Honey light amber.

Thyme (*Thymus vulgaris*).—The classical honey of Mount Hymettus was from this species.

Tickseed.—See SPANISH NEEDLES.

Thistle.—See CANADA THISTLE and SOW THISTLE.

Titi, white (*Cyrilla racemiflora*).—Ivory bush. An evergreen shrub or small tree that grows in pine swamps from Virginia to Florida and Texas. It blooms in Florida in mid-February; honey red, strong in flavor; used by bakers. A surplus is obtained only in northwest Florida, and there it is small, as the weather is usually rainy. In Georgia white titi extends up to the middle of the State. It is not a very sure nor a very abundant yielder; but it comes at a time when there is little else to keep the bees busy, and so is valuable. The quality of the honey is rather poor.

Titi, black (*Cliftonia monophylla*).—This is also an evergreen shrub found in pine swamps. In Georgia it is very common along the streams of the Altamaha River region. It blooms in March and April; the honey is in fair quantity, and of fair quality.

Tarweed (*Hemizonia fasciculata*).—Along the coast of southern California. Honey dark amber, with a strong tarweed odor; granulates in a few months; said to be used in the manufacture of chewing tobacco. Yellow tarweed (*H. virgata*) yields in central California a heavy light-yellow honey of good flavor.

Tulip tree (*Liriodendron tulipifera*).—White poplar, whitewood. A dark thick honey of rather inferior quality. In the South it blooms in April. —See TULIP TREE.

Tupelo, black (*Nyssa sylvatica*).—Northwestern Florida and southern Georgia. Honey white to amber in color; of good flavor, but rather thin. White tupelo (*N. aquatica*) is most abundant along the Appalachicola River. Honey is white, or with a slight yellowish tinge in the sunlight; thick, unsurpassed in flavor by any other honey in the State. It does not candy, even after years. Ogeche plum (*N. Ogeche*) yields in Georgia a light fine-flavored honey. See TUPELO.

Tobacco (*Nicotiana tabacum*).—In Connecticut the plants are permitted to flower and seed. From the first of August to frost there are hundreds of acres of tobacco flowers covered with bees. The honey is reported to be of fair quality.

Varnish tree (*Ailanthus glandulosa*).—Tree of heaven, Chinese sumac. Small greenish flowers; the staminate are ill scented, and the honey has a bad flavor.

Verbena or vervain (*Verbena*).—In California *V. prostrata* is of some value along the coast, but the species are mostly unimportant.

Vetch (*Vicia*).—Several species are visited by honeybees for pollen and nectar.

Viper's bugloss.—See BLUEWEED.

Wild cherry.—See PIGEON CHERRY.

Wild senna.—See CASSIA.

Willow (*Salix*).—Valuable in early spring for both nectar and pollen. In New York the honey is said to resemble that of apple bloom, and to have a pleasant aromatic taste; but in California it is described as bitter-flavored and amber-colored. —See WILLOW.

Willowherb (*Epilobium angustifolium*).—Canada, Michigan, and northern States. Flowers red-purple; honey clear, limpid, literally water-white; very sweet; aromatic.—See WILLOWHERB.

Wild alfalfa (*Lotus glaber*).—An important honey plant in the Coast ranges of California; honey white to amber; the yield is very variable in different years.

HONEY VINEGAR.—See VINEGAR.

HOREHOUND (*Marrubium vulgare* L.). This is quite an important honey plant in Texas and California. In Texas, Scholl says it yields nectar freely and steadily from February to July. It has

Texas horsemint.

been claimed that the honey is very bitter; but he declares that this is hardly the case in his locality; that it has a very sweet taste liked by some, but nauseating to others. In California, according to Richter, it is a splendid yielder of dark-amber honey, too strong for table use, but largely used in medicine. In Ventura and Los Angeles counties horehound is quite a common plant; but it is considered a pest on a sage range; for if even only a small quantity of its nectar is gathered, the color and flavor of sage honey is impaired.

HORSEMINT (*Monarda fistulosa*).—This plant was first brought to notice several years ago, and at that time the seeds were sold quite extensively as a honey-bearing plant. It was dropped and almost forgotten, until reports of large crops of honey, said to be from this source alone, began to come in. It first attracted attention on the alluvial low lands bordering on the Mississippi River; afterward, wonderful reports came of it, from different parts of Texas—one man reporting as high as 700 lbs. gathered by a single colony in a single season. The bees that did this wonderful feat were Cyprians, or, at least, were crossed with Cyprian blood.

Horsemint in Texas begins to bloom in May or June, and the honey is of good color and body, and fair flavor. It is a little strong, and on that account has been compared with Northern basswood. It is one of the very best honey-plants of Texas. One peculiarity of the flower is that it has very deep corolla-tubes—even deeper than those of red clover, so that bees with long tongues are a desideratum in Texas as well as in red-clover regions of the North.

HOUSE-APIARY.—See Apiary.

HUAJILLA.—(*Zygia brĕvifolia,* Sargent—pronounced as if it were spelled waheelya).—This is a very important honey-plant, or tree, rather, in Texas, for the dry arid portions where there is little or no irrigation, and where nothing, in

Huajilla.

fact, grows except mesquite, catclaw, sagebrush, and other desert plants. The fact that it does not depend on irrigation, and needs only a scanty amount of rain early in the season, makes it most valuable to the beekeeper in those regions where it grows and yields large quantities of beautiful water-white honey. Indeed, it is the finest produced in Texas, and is so nearly water-white as to be almost as clear as pure water. It is at its very best in the region of Uvalde, Texas.

The leaves look like a small delicate fern, and partake somewhat of the nature of the sensitive plant, for when touched they immediately close. The view is life size.

HYBRIDS.—A hybrid may be a cross between species or between varieties of a species. Bees mentioned under this head belong to the class last mentioned—a cross between varieties, and usually between Italian and common black bees. Everybody who has had Italians very long probably knows what hybrids (a cross between Italians and common black bees)* are, especially if he has kept bees when the honey crop was very suddenly cut short during a long and severe drouth in the fall of the year. If one buys an Italian queen that is pure, he can at once set about rearing queens if he chooses, for it matters not how many common bees there are around him; and if he rears all his queens as we direct under NUCLEI and QUEEN-REARING, he may have the full benefit of the Italians so far as honey-gathering is concerned, just as well as if there were no other bees within miles of him. This seems a paradox to most beginners, for we have letters almost daily, asking if it will be of any use to purchase Italians when other bees are kept all around them. If you are keeping bees for the honey they produce, and for nothing else, we do not know but that you are better off with other bees in the neighborhood. The queens that you rear will be pure like their mother; but after meeting the common drones, their worker progeny will of course be half common and half Italian, generally speaking. These are what we call hybrid bees. In looks they are much like the Italians, only a little darker. Sometimes a queen will produce bees all about alike; that is, they will have one or two of the yellow bands, the second and broadest being about as plain and distinct as in the full-bloods. Other queens will produce bees variously striped, from a pure black bee to the finest three-banded Italian.† We have had black queens fertilized by Italian drones, and these seem to be hybrids, just the same as the others. We have not been able to distinguish any particular difference.

As honey-gatherers, these bees that have the blood of the two races are, we believe, taking all things into consideration, fully equal to the pure Italians. There are times, it is true, when the pure stock seems to be ahead; but we think there are other times

* For test as to what constitutes a hybrid, see ITALIAN BEES.

† This is conclusive proof that the male was not a pure black. The offspring from a cross of pure parents of different races are uniform.—A. C. M.

and circumstances when the taint of black blood gives an advantage, in respect to the amount of honey gathered, that fully makes up the difference; and we would therefore say, if honey is your object, and nothing else, you are just as well off to let your queens meet such drones as they may happen to find. Why, then, do hybrid queens find slow sale at about one-fourth of the price of pure Italians? It is because of their excitability and vindictive temper.

Italians, as they generally run, are disposed to be quiet and still when their hive is opened, and to remain quietly on their combs while they are being handled, showing neither vindictiveness nor alarm. Black or common bees, on the contrary, are likely to become frightened, and either make a general stampede or buzz about one's head and eyes in a way quite unlike the Italians. Italians do not stand still because they are afraid to make an attack, for, let a robber approach, and they will sting it to death in a way so cool as to astonish one who has seen only common bees under similar circumstances. A race of bees so prompt to repel intruders of their own kind, it would seem, would also be prompt to repel interference from man; but such is not the case. They do not seem to be at all suspicious when their hive is opened and a frame lifted out. Well, these half-bloods inherit the boldness of the Italians, and, at the same time, the vindictiveness of the blacks; and to raise the cover from a hive of some hybrids (for some are much worse than others), without smoke, during cool or chilly weather, is a bold operation for even a veteran. Without any buzz or note of alarm, one of these daughters of war will quietly dart forth and inflict her sting before you hardly know where it comes from; then another, and another, until, almost crazed with pain, you drop the cover, and find that they are bound to stick to you, not only out into the street, but into the house or wherever you may go, in a way very unlike either pure race of bees. Sometimes, when a hive is opened, they will fix on the leg of one's trousers so quietly that you hardly dream they are there until you feel them stinging with a vehemence that indicates a willingness to throw away a score of lives if they had so many. This bad temper and stinging is not all. If you should desire to introduce a queen or queen-cell to these bees they would be very likely to destroy all you could bring; while a stock of either pure race would accept them without trouble. During extracting time, when taking off surplus honey, you will find little trouble, providing you work while honey is still coming in; but woe betide you if you should leave it on the hives until the honey-flow is past.

In preparing hybrid stock for wintering, we have seen them so cross that it was almost impossible to get in sight of the hive after they had once been roused up; and when we attacked them suddenly with smoker in excellent trim, they charged on us as suddenly, took possession of the smoker, buzzed down into the tube in their frantic madness, and made us glad to beat a retreat, leaving them in full possession of not only the "field," but the "artillery" as well. This was a very powerful colony, and had been unusually roused up. Although it was then quite cool weather, they hung on the outside of the hive watching for us, we suppose, until next morning. We then came up behind them with a great volley of smoke, and got them under and kept them so until we could give them cushions and put them in proper wintering trim. The queen was extremely prolific, and we do not know that we ever had one single queen that was the mother of a larger family of bees. Many of these hybrid queens are extraordinarily prolific.

Hybrids are more disposed to rob than Italians, but not as much so as the common bees. We decide thus, because, when at work among them, the bees that buzz about the hives, trying to grab a load of plunder if chance offers, are almost invariably full-blood blacks. They may have a dash of hybrid blood, but we judge not, because hybrids and Italians will often be at work when the blacks are lounging about trying to rob, or doing nothing. We have known a strong hybrid stock to be slowly accumulating stores in the fall when full-bloods, in the same apiary, were losing day by day. See Italian Bees.

HYBRIDS OF CARNIOLANS AND CYPRIANS WITH ITALIANS.

In this country, at least, we have as yet done very little to determine with accuracy the value of different crosses which can be made very easily. A cross between Italians

and Caucasians has been spoken of very favorably by Mr. J. J. Wilder, of Cordele, Ga., one of the most extensive beekeepers of the country. Mr. Wilder says this cross will rear brood under conditions and at seasons of the year when pure Italians will do practically nothing. In some parts of the South it is very desirable to have a strain that will rear brood in and out of season, because of certain honey-flows that may follow shortly after. A pure Italian stock has a tendency to stop brood-rearing almost entirely after the main honey flow. If there be another flow two or three weeks later, without brood-rearing in the meantime, the force will be greatly reduced, and the bees that are left will be of little value in a honey-flow.

In the same way a cross between Carniolans and Italians has been found to be equally profitable. Every beekeeper should, therefore, study his locality very carefully, and be prepared for every honey-flow that may come on. He should then test his various strains; and if he can not get just what he desires from a pure race, a crossing of two or more races may be found advantageous.

It may be well to observe that there are two ways of making crosses. For example, a large number of Carniolan or Caucasian drones may be reared, and all other drones, such as Italians, held back by means of drone-traps. If, as is generally supposed, the male has the greater potency in transmitting his qualities, it will be desirable to make a cross in this way: For example, Caucasians or Cyprians have a tendency to swarm and breed excessively. If these traits are too much of a good thing for the locality it can be toned down by crossing with another strain that is more conservative in both respects.

Other hybrids may be considered by the beekeeper who has in mind to produce a superior strain of bees for some particular purpose. We know that crossing, as a general rule, increases the size, courage, and stamina of our domestic animals; and it is probably so in bees, yet we have made but little progress along this line, because it is so difficult to distinguish between the crosses and pure breeds in many cases.

We have an imperfect control over bees when mating, hence it is very difficult to effect mating just as we desire to have it. In this connection there is a grand field for practical experiments, such as would prove useful to beekeepers.

I

INCREASE.—Under the head of NUCLEUS several methods of forming nuclei are explained; but under this head we shall deal with the subject more from the standpoint of the honey-producer who actually desires increase and at the same time produce a crop of honey. One can divide up a strong colony into three or four nuclei; but in doing so he would probably destroy all his chances of securing a crop of honey, and at the same time be almost sure to cause some brood to die. It should always be borne in mind that the field bees will go back to the old stand. The nucleus left will necessarily receive more than its proper proportion of bees, while those moved to the other locations may or may not (depending upon circumstances) have too few bees to take care of young brood. The loss of brood may be minimized somewhat by putting most of the sealed brood on other stands and a large part of the unsealed at the old stand; but if the division be made during chilly weather even the sealed brood may die from chilling.

The plan that we are about to describe avoids all this loss of brood, and at the same time enables one to make a moderate increase as well as secure a honey crop. It was practiced and recommended by one of the most extensive beekeepers in the United States, the late Mr. E. W. Alexander, who was recognized as an authority on general practical apiculture, for indeed his crops of honey went up into the carloads. He first made the plan public in 1905, after having tested it many years. So many favorable comments were received of beekeepers who had tried it and found it to be a success that we republished it with some slight modifications in 1906. We here present the plan as it was given in *Gleanings*, page 423, 1906:

When your colonies are nearly full enough to swarm naturally, and you wish to divide them so as to make two from one, go to the colony you wish to divide; lift it from its stand and put in its place a hive containing frames of comb or foundation, the same as you would put the swarm in providing it had just swarmed. Now remove the center comb from this new hive, and put in its place a frame of brood from the old hive, and be sure to find the queen and put her on this frame of brood in the new hive; also look it over very carefully to see that it contains no eggs nor larvæ in any queen-cells. If it does, destroy them. Now put a queen-excluding honey-board on top of this new hive that contains the queen and frame of brood with their empty combs, then set the full queenless colony over the excluder; next put in the empty comb or frame of foundation taken from the new hive, and close the upper hive except the entrance they have through the excluder into the hive below. Leave them in this way about five days, then look over the combs carefully, and destroy any larvæ you may find in the queen-cells unless they are of a good strain of bees that you care to breed from, for they frequently start the rearing of queens above the excluder very soon after their queen was placed below the excluder. If so, you had better separate them at once; but if they have not started any queen-cells above, then leave them together ten or eleven days, during which time the queen will get a fine lot of brood started in the lower hive, and every egg and particle of larva that was in the old hive on top will have matured; so it will be capped over and *saved;* then separate them, putting the old hive on a new stand. It will then be full of young bees mostly, and capped brood, and in about twenty-four hours they will accept a ripe cell, a virgin, or laying queen, as they will then realize that they are hopelessly queenless. I would advise you to give them a laying queen, as I never like to keep my full colonies for even a day longer without a laying queen than I can help.

In this way you secure two strong colonies from one, without losing a particle of brood or checking the laying of this queen; and with me it almost wholly prevents swarming. This is the way we have made our increase for several years, and we like it much better than any other method we ever tried. In doing so we keep all our colonies strong during the whole summer, and it is the strong colonies that count in giving us our surplus.

The mere fact of having a large number of colonies does not amount to much unless they are strong in bees and are *well* cared for at all times. This is a fact that many have sadly overlooked; and when the season comes to a close, giving them a small surplus, they feel disappointed and lay the fault on many things that have had but little to do with their failure.

In making increase in the above way the new swarm on the old stand is in fine shape for a super of sections, as it has a large working force backed up by having its hive nearly full of brood, and but little honey, as the bees have been in the habit of storing their honey in the old hive that was on top, so they will soon go to work in the sections with no notion of swarming. Then the old hive that has been set away can usually spare 15 or 20 lbs. of honey, which can be taken with the extractor, giving its new queen plenty of room to lay, and in a short time will be one of your best colonies, and also have no desire to swarm.

Now, if you have done your duty by your bees since taking them from their winter quarters, as I

have recommended in the above, keeping them snug and warm, and feeding them a little thin warm syrup nearly every day for the first thirty days after they have commenced to fly, you can have two good strong colonies in the place of one ready to commence work on your clover harvest, which here commences about June 15.

From an extensive experience along this line I find I can get nearly twice the amount of surplus by dividing as above stated over what I was able to acquire either by letting them go undivided or dividing in a way that caused the loss of a greater part of their brood.* This losing of brood we must guard against at all times if we expect to secure a fine surplus. It costs both time and honey to produce it, and it is the principal factor in obtaining those strong colonies that give us tons of honey.

Several years ago one of my sons bought nine colonies of bees in common box hives, about the first of June. He brought them home and transferred them at once to movable-frame hives, and in about three weeks divided them, making 20 colonies of the 9 he bought, using some queen-cells I had on hand for his surplus colonies. He then attended to those 20 colonies so they were all strong at the commencement of our buckwheat harvest. I then lent him 20 hives of empty combs to put on top of his colonies to extract from. He took 2849 lbs. of extracted honey from those 9 colonies and their increase, and left them in good condition so every one came out the next spring in fine order.

Another son, the same season, took one colony, divided into three, and received 347 lbs. of extracted honey. They also came through the following winter in good condition. I speak of these cases simply to show that it is not necessary to keep hundreds of colonies in order to get a little honey. If you will keep only strong colonies and give them the best of care you will soon find both pleasure and profit in bee-keeping.

Now, in regard to the criticism on this way of making our increase, which has been published in *Gleanings,* I find that nearly all who have made a failure of the method have taken colonies that had already made some preparation for swarming by having eggs or larvæ in their queen-cells.

During the summer I received a few letters from parties who had made a failure of this method in about the same way. Some had taken colonies that had capped queen-cells in their hives at the time they put the queen in the under hive, and, of course, they swarmed in a day or two. I can not see that these failures are any proof of fault in the method. When we work with our bees we must always use some discretion in such matters. If a colony is very strong in bees it certainly requires different management from one rather weak.

For particulars on making increase by shaking, or by the J. E. Hand plan, see ARTIFICIAL SWARMING; also NUCLEUS.

INKBERRY (*Ilex glabra*).—This little variety of the holly family, with its velvety leaves, not sharp-spined, as in the gallberry, but fuzzy and soft, grows widely along swamps and water-courses, pretty generally all over Florida—in fact, any place where there is a slight suggestion of water near the surface. It blooms about mid-May, having a small cream-colored blossom, the entire shrub not being over two feet high, on the average. There is both honey and pollen, the latter being rich cream-colored. The beeman can always tell when the inkberry comes into bloom. It yields honey almost unfailingly, but not every apiary is near enough large water-courses to make a showing in the supers. It is invaluable for stimulative purposes, as it comes at a time when, in many sections, just such forage is needed to put colonies in best condition for the later yields of palmetto or mangrove. It overlaps the bloom of the scrub palmetto, coming on a week or so earlier as a rule.

INTRODUCING.—Under normal conditions only one queen will be tolerated in a colony at a time. Should there by accident be two, when they meet there is likely to be a royal battle, until one of them is killed. So it happens that queens are, as a rule, jealous rivals; but there are exceptions. Under certain conditions, as when an old queen is about to be superseded, the young daughter may be tolerated in the hive along with her mother—both laying side by side; but in the course of a few days or weeks the mother will be missing. Whether she dies of old age or the daughter kills her we do not know. There are other conditions where two and sometimes a dozen queens will be found in the hive, but under circumstances which seem to be abnormal.

Again, it may be stated that a normal colony of bees will not take a strange queen, even though they have no mother of their own, much less will they accept an interloper when there is already a queen in the hive. We may, therefore, lay it down as a rule that has exceptions* like all other good rules, that we can not let loose any queen, young or old, to a colony that already has one. Moreover, bees that are queenless will not, under ordinary conditions, accept another, no matter how much they may need one, until she has been "introduced." It follows, then, in the process of requeening we are compelled to put a new queen in a wire-cloth cage and confine

* This may be true as to Mr. Alexander, but as a general teaching it is greatly misleading. If I should follow the plan it would only be at a loss in the honey crop. What successful man follows it?—C. C. M.

* If a virgin queen, on returning from a mating-trip, enters by mistake a hive where there is an old laying queen she may, and very often does, supplant the old queen. The virgin is young and vigorous, and more than a match for the old queen full of eggs. Even though the colony odor be lacking, the bees in this case accept the supplanter.

her there (where the other bees can not attack her) until she has acquired the same colony odor or individual scent as the bees themselves. This usually takes two or three days, at the end of which time the queen may be released and they will treat her as their own royal mother. We do not know how bees recognize each other, or how they can tell a strange queen from their own, except by scent factor.

It is a fact well recognized that a dog can pick out his master from hundreds of others through the agency of scent; nay, further, he can track him if he loses sight of him by catching the scent of where he has walked, in spite of the fact that hundreds of other people may have gone over the same ground. This scent that is so acute in a dog is undoubtedly highly developed in the bee, otherwise we should be at a loss to account for some of the phenomena in the domestic economy of the hive. See Scent of Bees.

Hence we naturally conclude that, by the sense of smell, bees recognize their own mother from a new or strange one.

Again, we learn that, if two queens have exactly the same colony odor after being caged for two or three days in a queenless hive, either one may be liberated and the bees will accept one just as readily as the other. If both be liberated at the same time, one in one corner of the hive and the other in the opposite corner, both will be tolerated by the bees; but once the queens come together themselves there is danger of a royal battle* resulting in the death of one. From this fact we infer that the bees, providing a queen or queens have the requisite colony odor, will accept at any time one or more such queens under many conditions; that, further, when two queens have the same colony odor, if they can be kept apart by means of perforated zinc both will continue to lay eggs in the same hive without let or hindrance. This condition will be allowed so long as the colony prospers, until a dearth of honey comes; then the bees show a disposition to rob, and they may destroy one of the queens.

Bees that have been thrown into a box or pan, and then shaken or bumped again and again until they are demoralized or frightened, are much more tractable than those not so disturbed. Such bees if made queenless just prior to the shaking, and confined without combs or brood in a cool place for a few hours, will usually accept a queen at once. The factor of colony odor then apparently does not operate, for the bees are put out of their normal condition.

Very often the queens of two colonies may be made to exchange places. The two hives are opened, and before either colony can discover that it is queenless, the queens are exchanged; but when this exchange is made, the precaution must be taken to open the hives very quietly, using but little smoke. The idea seems to be to disturb the colony as little as possible, so that their normal condition may continue. Not suspecting any change in queens, the bees are not looking for any, and allow the new mothers to go right on where the previous queens left off. On the other hand, if either colony is queenless long enough so that it sets up a loud buzzing or a cry of distress, it will be pretty sure to ball any queen that may be given it.

Young bees just hatched will at any time accept any queen. Therefore, it comes about that, when one desires to introduce a valuable breeder on which he desires to take no chances whatsoever, he causes her to be released on a frame of very young or hatching bees; but consideration will be given to this later.

Virgin queens, if just hatched, will usually be accepted by a colony, if not too long queenless, without the process of introduction or even of caging; but when one of these queens comes to be four or five days old she is very much more difficult to introduce than a normal laying queen.

When a little honey is coming in, it is much easier to introduce and unite bees than during a dearth.

A queen in the height of her egg-laying will be accepted far more readily than one that has been deprived of egg-laying, as in the case of one that has been four or five days in the mails.

Some colonies are more nervous than others. To open a hive of such on an unfavorable day might arouse the inmates to a stinging fury. Indeed, such colonies will

* We say "danger" of a battle. Queens will not always fight when so put together. The relative ages of the queens makes a great difference. If one queen be an old one there probably will be no fight, and even if there is, the young queen will be more than a match for the old one.

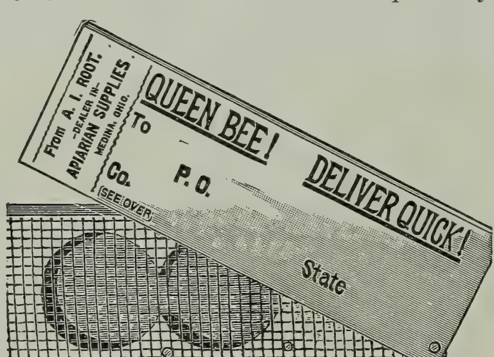
often ball and sting their own queen when the hive is opened if the day is unfavorable.

It is easier to introduce toward night, or after dark, than during the day. The reason of this is that after dark the excitement of the day has subsided. There is no chance for robbing and no reason for vigil. In short, bees are not *expecting* trouble and are not inclined to make any.*

A fasting queen, or, rather, a queen that is hungry, will usually ask for food, and hence will generally be treated more considerately than one that shows fear or fight.

Having stated, therefore, the basic principles governing the relation of the queen to the bees we can now more intelligently proceed to the methods of introduction, most of which are based on the theory that the queen to be introduced must first have acquired the colony odor of her new subjects.

The cages are supplied with bee candy (see CANDY), so that, in case the bees do not feed the queen, she will not starve. In some cases the bees release the queen by



Benton mailing-cage. Postage on this cage is one cent. A larger size for longer distances, as shown next page, requires two cents.

eating away the candy and letting her out, or they may tunnel under the cage by tearing away the comb, and releasing her. In other cases the apiarist himself liberates her after she has been confined the requisite length of time, or until such time as she has acquired the colony odor.

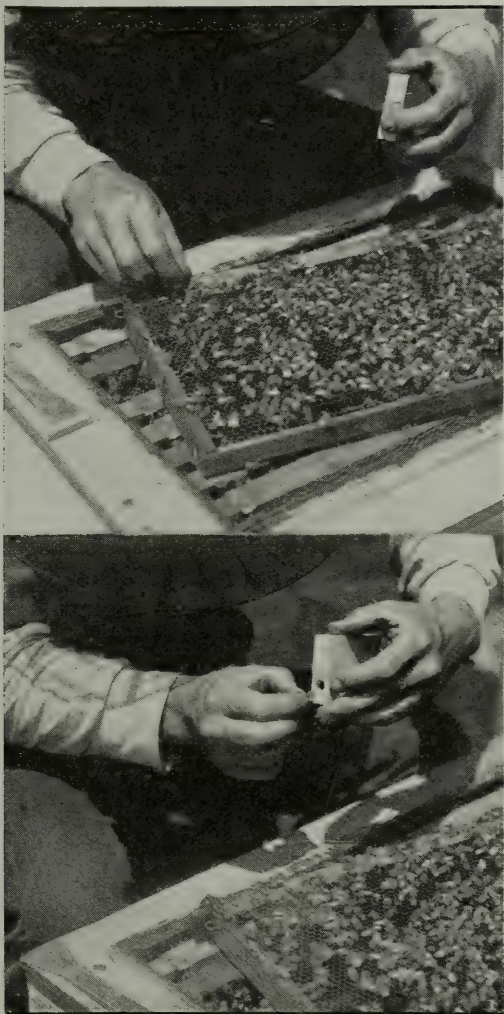
Most of the cages are sent out by queen-breeders with directions how to perform this operation; and it is usually safer for the beginner to follow these directions implicitly.

The mailing and introducing cage that has been used over the country is called the Benton, and is shown in the accompanying illustration. This consists of an oblong block of wood with three holes bored nearly through, one of the end holes being filled with Good candy (see CANDY), and the other two are left for occupancy by the bees and queen. On the back of the cover are printed full directions for introducing, and at each end of the cage is a small hole bored through lengthwise the grain of the wood. One hole (next to the bees) is covered with a piece of perforated metal, secured in place with two small wire nails driven through the perforations. The other hole (that is, at the candy end) is covered over with a piece of pasteboard perforated by a line of pinholes running through the center. The object of these perforations is to give the bees an opportunity to taste the candy through the holes of the pasteboard; and once having gotten a sip they will gnaw the holes larger, and finally pull away the pasteboard entirely.

Very often, after the cage has been through the mails, and been on the journey for several days, the bees in the cage will have consumed two-thirds or three-fourths of the candy. If those in the hive to which the queen is to be introduced gain access to the candy direct they would eat out what little there is of it in five or six hours, liberate the queen, and probably kill her. In order to accomplish introduction safely the cage should be on the frames (where the bees can get acquainted with the queen) for at least 24 hours, and longer wherever practicable. As it takes anywhere from 12 to 24 hours for the bees to gnaw away the pasteboard before they can get at the candy, and from 6 to 24 hours to eat out the candy, we are assured of at least 18 hours before the bees can release their new mother; and generally the time is longer—anywhere from 24 to 48 hours. The pasteboard has another advantage, in that it makes the introduction entirely automatic. The one who receives the queen pries off the cover protecting the wire cloth, and then by the directions which he reads on the reverse side of this cover he learns that all he has to do is to lay the cage wire cloth down

* Note this factor. All the bees are at home (virtually all) and all are brought to the same condition. Not so in the busy part of the day, for ten thousands of bees are pouring in from the fields and they were uninfluenced by the beekeepers' work, and they are the ones which I believe make the trouble. How or why I do not know.—A. C. M.

over the space between two brood-frames of the queenless colony, *and the bees do the rest.* It is not even necessary for him



How bees and queens are put up in a mailing-cage.

to open the hive to release the queen; indeed, he should let the colony entirely alone for three or four days, as opening the hive disturbs and annoys the bees* to such an extent that very often they will ball the queen, seeming to lay to her door what must be to them a very great disturbance in having their home torn to pieces.

There are several sizes of these Benton cages—the larger ones being used for longer distances. The one shown is good for 1000 miles through the mails, although very often used for twice that distance. This may be called a combination mailing and introducing cage. Ordinarily, if we have much introducing to do we prefer something especially adapted to the latter purpose alone; we have, therefore, used with a great deal of satisfaction the Miller introducing-cage.

As many of the readers of this work may possibly do something at mailing queens, it might be well to add a word about making the candy for Benton cages. This should be prepared as directed under CANDY. It should be made several days in advance of the time it is expected to be used; for after it has been made it will soften down and become quite sticky. If put in cages in this condition it will result in the death of the bees and queen before accomplishing half their journey. After the candy has stood several days it is likely to become soft again, when more sugar should be kneaded in. It would be better then to let it stand two or three days, and then, if necessary, knead in more sugar

Putting queens and bees in export Benton mailing-cage.

until it holds its consistency so that the dough is *stiff, moist, and mealy.* This is important. It is almost equally important to have the candy hole coated over with hot paraffine. This is for the purpose of preventing the absorption of the honey out of the candy into the wood. The candy should then be crowded into the candy

* Why may it not be that the *queen* is startled and begins to run? As a laying queen (unless very timid) does not meet with such trouble, and as a queen which has fasted is also safe, and also as a queen temporarily restrained by honey, flour, or something similar is safe, even with cross bees, I believe it is the queen's rather than the bees' fault.—A. C. M.

hole, and then the hole in the end over which the pasteboard is to be tacked should be plugged full of candy, after which the pasteboard may be nailed on.

The manner of filling a cage for mailing is to pick it up with the left hand in such a way that the thumb covers the hole over which the perforated metal has been nailed, but which, before the time of filling, should be revolved around on one side or taken off entirely. The queen is first to be picked up by the wings, her head pushed into the hole as far as possible. After she runs in, place the thumb over the hole. Worker-bees are next picked up in a similar manner, and poked in, selecting those that are filling with honey from open cells until there are a dozen bees. If the cage is larger, two dozen may be used; and if it is extra large, four or five dozen. When cages are mailed during cold weather there should be more bees put in, to help keep up the animal heat. During hot weather a dozen bees are quite sufficient in the smallest Benton cage.

PUSH-INTO-COMB-CAGE PLAN OF INTRODUCING.

During 1911 and '12 there was considerable discussion in the bee journals concerning the method of introducing known as the push-into-comb-cage plan—that is to say, a plan which permits of a queen being caged over a few cells of honey and brood. This is accomplished by taking a square of wire cloth of suitable size and cutting a small square out of each of the four corners. The projecting ends are then folded down so as to make a wire-cloth box without bottom. This is pushed into a brood-comb with the queen under it. If it is not pushed in too deep, the bees will usually release her in 24 to 48 hours by gnawing under or tunneling under the wire cloth. Reports of this method of introducing have been uniformly favorable, and one reason for this is due to the fact that the queen has immediate access to cells of honey; and if she should lay a few eggs in the comb before she is released she will have the odor of a laying queen, and this odor is one of the elements that go to make up successful introduction.

Some years ago one of our prominent queen-breeders offered to replace all queens that he sent through the mails, providing this plan of introduction were followed. He reported that it was so successful that he scarcely ever had to replace a queen; and he believed that these replacements were due mainly to the fact that the recipient failed to carry out his instructions.

But one difficulty with a plan like this is that not every one will have on hand the proper material nor have the necessary skill for making up a cage of this sort. Another and more serious difficulty is the problem of getting the queen transferred from the *mailing-cage* to the introducing-cage pushed in the comb, without injuring her or allowing her to get away during the process. Another difficulty is that some push the cage into the comb so far that

The new mailing and introducing cage with carton.

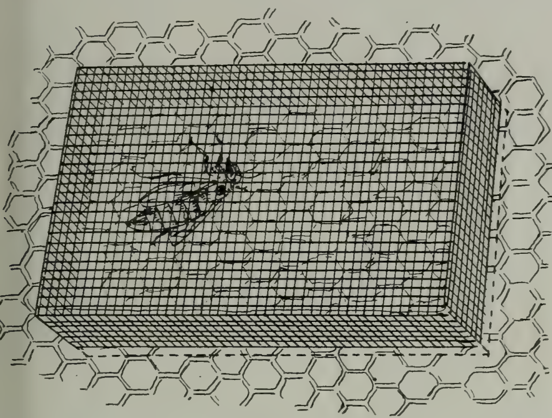
the bees fail to release her, although in such cases no harm results, because the apiarist can remove the cage and allow her to run at large in the hive.

The difficulty of making a *combination* cage so that both can be sent in the mails, and at the same time not increase the postage, is solved by making the introducing-cage of just the right size to telescope over the mailing-cage. Both can then be slipped into a neat carton to stand the rough usage of the mails. The accompanying illustrations will show how this scheme can be carried into execution.

The following are the directions that are used in cages of this kind:

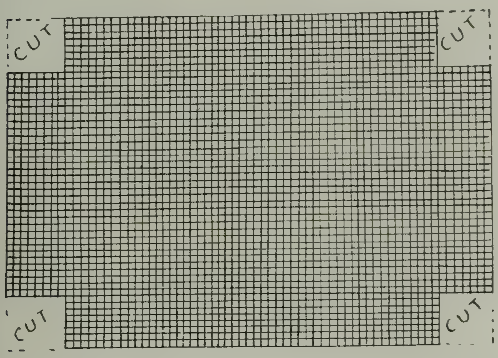
On receipt of the queen go to the hive where you propose introducing her, and remove the old

queen, and before the bees discover that the old mother is gone, cage the new queen among them. To do this, select a comb containing hatching brood, eggs, and cells of honey. Find a spot on the comb where there is hatching brood, eggs, and

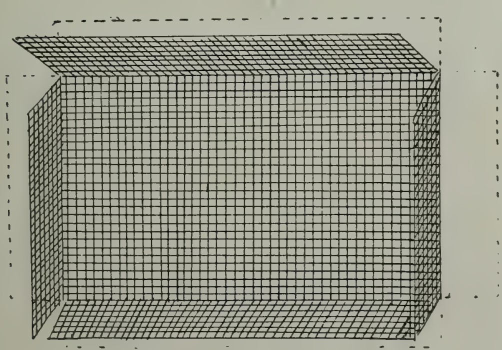


Cage pushed into the comb, showing the manner of introducing the confined queen.

cells of honey contiguous in a spot about the size of the cage. If there is no hatching brood, cells of pollen and honey will do very well. Shake the bees off the comb and carry comb and queen received from the mails into the house before a window.



The manner of folding the cage.



Wire-cloth corners cut out before folding to make the introducing cage that telescopes over the wooden part.

Gently raise the wire-cloth top that telescopes over the wood part until it is almost off. Wait a few moments until the queen works her way upward on to the wire cloth; then quickly lift the wire-cloth cover, with queen on it, off the wood part and shove it on to the selected spot on the comb. But suppose that, during the operation, she flies. Don't get excited. She will quickly go to the window, where it will be easy to cage her by gently slipping the wire-cloth introducing part over her. The next operation is to slide a postal card between the wire-cloth cage and the window, being careful not to pinch the queen in the operation. Lift cage and all with the postal card away from the window, and lay both on the comb. Gently draw out the postal card until the queen crawls on the comb, then shove the wire-cloth cage down into the comb until it is almost to the midrib. In doing this, care should be exercised so there may be no gaps at the corners where the wire-cloth sides and ends are folded down.

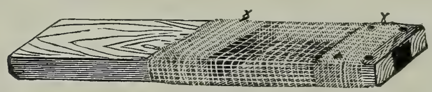
In from 24 to 48 hours the bees may tunnel under and release the queen. If at the end of 48 hours the queen is not out, she may be released by pushing a pencil through the comb from the side opposite where the queen is caged. In an hour or so the queen will find her way out easily. We believe it important that she should have her liberty when conditions in the colony are entirely normal. A disturbed colony, or one that is opened up and pulled to pieces, is much more apt to ball a queen than one that is going on with its regular routine.

One very great advantage with this form of introducing is that it avoids the possibility of transmitting bee diseases through queen-cage candy. See Foul Brood. If the candy is made of honey that has come from a hive infected with foul brood, it would be the means of carrying the disease through the queen-cage to the hive, providing the candy method previously described were used. To offset this difficulty the Postoffice Department, during the early part of 1912, issued a ruling to the effect that no queen should be sent through the mails unless accompanied by a copy of a certificate from a bee inspector or a copy of a sworn statement to the effect that the queen-breeder boiled his honey that he used in his queen-cage candy for thirty minutes in a closed vessel; but not every one would do this work properly, and perhaps not every queen-breeder would be conscientious in carrying out this regulation. If the push-into-comb-cage plan were used, it would eliminate all possible carrying of disease in this way unless the recipient of the cage were careless enough to throw it outdoors where his bees could get at it; and he would hardly do that.

MILLER'S INTRODUCING-CAGE.

It is very convenient to have in the apiary small special cages for introducing and holding queens that come out with swarms until they can be introduced or dis-

posed of. The one illustrated below is an excellent one. It is especially handy for introducing young virgins. The cage is so flat it can slide in at the entrance without even removing the cover of the hive, and the bees will release the queen by the candy method. Yet for introducing fertile or valuable queens we recommend inserting it between two combs and drawing them together until they hold the cage. The queen thus acquires the scent of the combs, brood, and the cluster, and hence when released will be more likely to be accepted.



This cage, like the Benton, will give very much better results if a piece of pasteboard is nailed over the end. This the bees will gnaw away, gaining access to the candy, which they eat out. Since we discovered the value of the pasteboard used in the manner stated, with either the Benton or the Miller cage we are able to introduce a larger per cent of all queens, providing, of course, the colony has not been queenless more than four or five days. One that has been without a mother longer may get to depending on cells; and when the work has so far progressed they are liable to destroy the introduced queen and await the hatching of one of the virgins.

We copy its manner of construction from Dr. Miller's own words:

> Take a block 3 inches long, 1¼ wide, and ⅜ thick; two blocks 1 inch by 7-16x⅜; two pieces of tin about an inch square; a piece of wire cloth 4½x3½; two pieces of fine wire about 9 inches long, and four small wire nails ½ or ⅝ long. That's the bill of material. Lay down the two small blocks parallel, ⅜ of an inch part, one piece of tin under, and one over them. Nail together and clinch. These two blocks, being ⅜ inch apart, make the hole to fill with Good candy, through which the queen is liberated.

Another feature of this cage, of great importance to beginners, is as a queen-catcher. It can be put down over the queen after the wooden slide is removed, and when she crawls upward the plug is replaced.

A SURE WAY OF INTRODUCING.

There is one perfectly sure way of introducing a very valuable queen, such as an imported one, if we only observe the conditions carefully. Remove two or three frames of hatching brood from several hives; shake off every bee, and put the brood into an empty hive closed down to a small space; and unless the weather is very warm, place the whole in a warm room, or over the hive of a strong colony with double wire cloth between the two. Let the queen and her attendants loose in this hive, and the young bees, as they hatch out, will soon make a swarm. As several who have tried this plan have been so careless as to leave the entrance open and let the queen get out, we would warn you especially to have your hive so close that no bee can by any possibility get out.* If the frames you have selected contain no unsealed brood, you will have very little loss; but otherwise the larvæ, having no bees to feed them, will mostly starve. As soon as a few hundred bees are hatched, the queen will be found with them, and they will soon make a cluster. When the combs have been taken from strong colonies, where the queen is laying hundreds of eggs in a day, in a week or two the swarm will become strong. Three frames will do very well at first, and one or two more may be added in the course of a week or two. Remember, *no live bee* is to be given to the queen, and remember that the hive must be kept in a warm place—the nearer 90 degrees F. the better. A queen is seldom lost, even by the first plan given, if you are careful, and watch them until they are safely received.

There is another way that has proved to be good. In order to describe it we can do no better than to make an extract from an editorial in *Gleanings in Bee Culture*, page 539, Vol. XXI.:

> We have just received a consignment of 30 imported Italian queens, direct from Italy, by express. Every queen came through alive and in good order, and they are now introduced into the apiary without the loss of one. Our method of introducing with this lot was something we had not tried before on so large a number of queens. We took four or five strong colonies, and divided them up into 30 one-frame nuclei. This was done in the forenoon. In the afternoon we transferred the imported queens, without any attendants, to Miller introducing-cages, placing one in every nucleus above mentioned. Most of the queens were out at the expiration of two days, in good order, and they are now all out.
>
> You see, the point is here: These newly divided nuclei will have old and young bees, and more or less hatching brood. Before the imported queen is released, the *old* bees will have returned to the old stand, and it is these old fellows that always make trouble in introducing. By the time the queen is released, there are none but *young* bees, including

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* They can be set out and allowed to fly in five or six days.

those that were brought to the nucleus-stand and those that are hatched out in the interim. These, of course, all being young, will accept their new mother, without any trouble. The plan has proved to be so satisfactory that we shall employ it hereafter for all valuable queens.*

DIRECT METHOD OF INTRODUCTION.

Where it is desired to introduce a queen from a nucleus to a queenless colony, both in the same yard, the operation can usually be performed with safety and with very little labor, as follows: The colony to receive the queen should be made broodless a few hours in advance. Go to the nucleus and lift out two frames, bees and all, with the queen in between. Put these down in the center of the queenless colony; close up the hive and don't go near it for several days. The bees that have been queenless and broodless are crying for a mother. When she is given them with a large force of her own subjects, she seems to be protected, even if she does not have the odor of the new colony which, by the way, has been modified by the bees and brood given them from the other hive.

This is a modification of the Simmins direct method of introducing. It could not be used in the case of a queen sent through the mails.

THE SIMMINS FASTING METHOD.

While this has been discussed to a greater or less extent in the bee-journals, the plan, while very simple, is not one that we would recommend in the case of a valuable queen, or in any event to a beginner. It is as follows: The queen to be introduced should be put in a cage at night without attendants and without food. She should thus be confined for thirty minutes when she must be released by lamplight over the frames of the queenless colony, and the hive closed up for 48 hours.† This will work safely in many cases, but we are sure there are some conditions where it does not.

DUAL PLAN OF INTRODUCING.

Another plan is to introduce two virgins or laying queens at one operation to save the necessary time it takes for the bees to get acquainted with the queen. This is described in detail under the head of QUEEN-REARING, to which the reader is directed.

HOW SOON WILL AN INTRODUCED QUEEN BEGIN TO LAY?

As a general thing, we may expect her to begin laying the next day; but sometimes, especially if the queen has been a long time prevented from laying, as in the case of an imported queen, she may not lay for three or four days, or even a week. If introduced in the fall of the year, she may not commence laying at all until spring, unless the colony is fed regularly every day for a week or more. This will always start a queen that is good for any thing if the weather is warm enough.

HOW TO TELL WHETHER A COLONY IS QUEENLESS OR NOT.

Having discussed mailing and introducing cages, it may be pertinent at this point to give one of the prime essentials in successful introducing. The very first thing to be determined before you attempt to introduce at all, is that your colony is *certainly* queenless. The fact that there may be no eggs nor larvæ in the hive, and that you can not find the queen, is not sufficient evidence that she is absent, although such a condition points that way. But during the earlier part of the summer there should be either brood or eggs of some kind if a queen is present. Yes, there should be eggs or brood clear up until the latter part of summer. In the fall in the northern States, or after the honey-flow is over, old queens generally stop laying, and shrivel up in size so that a beginner might conclude that the colony is queenless, and therefore he must buy one. In attempting to introduce the new queen, of course he meets with failure, as she is stung to death, in all probability, and carried out at the hive-entrance. If you can not find eggs or larvæ at any season of the year when *other* stocks are breeding, and the supposedly queenless colony builds cells on a frame of unsealed larvæ that you give them, you may decide that your colony is surely queenless, and it will be safe to introduce a new queen.* But when you find eggs, larvæ, and sealed *work-*

* I've used the same plan with a full colony. Set the colony on a new stand, leaving the old stand a hive with a frame of brood to catch the fielders. After introduction the hive may be returned.—C. C. M.

† Do not close the hive unless ample ventilation and shade is given. By throwing the bees into an acute uproar with smoke, and doing it near nightfall when all bees are in, queens may be run in without any fasting, regardless of whether they are just from the mails or from the combs of a nearby hive.—A. C. M.

* Sorry to say I have had them start cells when a virgin was present.—C. C. M.. [Me too!—A. C. M.]

er brood, the presence of queen-cells simply indicates that the bees are either preparing to supersede their queen or making ready to swarm. See SWARMING.

We said old queens would stop laying in the fall if no honey was coming in. It is proper to say that young queens will lay, flow or no flow. See SPRING DWINDLING.

HOW LONG SHALL A COLONY BE QUEENLESS BEFORE ATTEMPTING TO INTRODUCE?

We prefer colonies that have not been queenless more than a couple of days—just long enough to see cells start, and just long enough so the bees begin to recognize their loss, but not long enough for them to get cells under way. Cells nicely started or capped over are quite apt to make the colony act as if it wanted something of its own; and when a laying queen is introduced to them they take a notion sometimes that they *won't* have any thing but their own raising.

The worst colony to introduce a laying queen to is one that has been queenless long enough so that there is a *possibility* of one or more virgin queens being in the hive. It is hard to decide definitely in all cases when such colonies are queenless. Most young virgins, after they are three or four days old, are very apt to be mistaken for workers, especially by a beginner. It is not always practical to wait until the colony starts to build queen-cells, especially if you happen to have a nice surplus of laying queens for which you wish to find room.

WHAT TO DO IF BEES BALL THE QUEEN.

When we introduced queens in the old-fashioned way—that is, before cages were constructed so as to release queens automatically—we used to experience much trouble by bees balling queens. If they were not ready to accept her when she was released by the apiarist, they were pretty sure to ball her. But here is a point that it is well to observe: When the *bees* let out the queen they very rarely ball her. But when it is necessary for the *apiarist* to perform the work, opening the hive, accompanied by general disturbance, is apt to cause them to ball her as soon as released. Well, suppose they do ball her. Lift the ball out of the hive and blow smoke on it until the bees come off one by one, but don't blow hot smoke on the queen. When you can see the queen, get hold of her wings and pull the rest of the bees off from her by their wings. Do not be nervous about it, and you can get her loose and cage her again. Put more candy in the opening, and give her another trial. Some one—we do not remember who — advised dropping the queen, when she is balled, into a vessel of water. The angry bees will immediately desert the queen, when she can be easily taken out of the water, and recaged.*

It may be well to explain in this connection that bees are very much more apt to ball a queen that shows fear than one that behaves as if she expected kind treatment. If a new queen just introduced throws up her feet, and squeals, she is pretty sure to get into trouble.

WHAT TO DO WHEN THE QUEEN FLIES AWAY.

Sometimes a beginner is very nervous, and by a few bungling motions may manage to let the queen escape from the hive where he expects to introduce her. Or this may happen: The queen may take wing right off from the frame—become a little alarmed because there are no bees about her, and fly. In either case, step back immediately after opening the hive, and in fifteen or twenty minutes she is quite likely to return to the same spot, and you must not be surprised if you find her again in the hive. If you do not discover her in the hive near where you are standing, in about half an hour look in other hives near by. If you see a ball of bees somewhere down among the frames, you may be quite sure that here is the queen that flew away, and that she has made a mistake, and entered the wrong hive.

INTRODUCING VIRGIN QUEENS.

As previously explained, a young virgin just hatched, generally weak and feeble, can usually be let loose in a queenless colony without caging, and be favorably received; but one from two to six days old is, as a rule, much more difficult to introduce than a laying queen; and one ten days old, more than old enough to be fertilized, is most difficult. Such queens *can* be introduced, however, but generally it is a waste of time to attempt it in a strong vigorous colony. Better by far give them a cell or a virgin just hatched, thus saving time and

* I've done it lots of times; it's fine; better than smoke but not so convenient.—C. C. M.

vexation; for even should the old virgin be accepted, she may be deprived of a leg, or be so deformed from rough treatment as to become in a large measure impaired for usefulness. Under head of QUEEN-REARING we describe "baby nuclei;" and, as already stated, it is much easier to introduce any queen, either virgin or laying, to a nucleus or weak force of bees than to a strong vigorous colony; so if we would attempt to introduce four or five day old virgins, give them to nuclei—the smaller and weaker the better.

INVERTING.—See REVERSING.

ITALIAN BEES.—At present the Italians, and even hybrids, have shown themselves so far ahead of the common bee that we may safely consider all discussion of the matter at an end by the great majority of beekeepers. Many times we find colonies of hybrids that go ahead of pure stock; but as a general thing (taking one season with another), pure Italians, where they have not been enfeebled by choosing light-colored bees to breed from, are ahead of any admixture. There has been a great tendency with bees, as well as other stock, to pay more attention to looks than to real intrinsic worth, such as honey-gathering, prolificness of the queens, hardiness, etc.; and this may have had much to do with the severe losses we have sustained in winters past.

Even if it were true that hybrids produce as much honey as pure Italians, each beekeeper would want at least one queen of absolute and known purity; for although a first cross might do very well, unless he had this one pure queen to furnish queen-cells he would soon have bees of every possible grade, from the faintest trace of Italian blood, all the way up. The objection to this course is that these blacks, with about one band (with the exception of the Eastern blood), are about the worst kind of bees to sting, being very much more vindictive than either race in its purity; they also have a very disagreeable way of tumbling off the combs in a perfectly demoralized state whenever the hive is opened, except in the height of the honey season, and of making a general uproar when they are compelled, by smoke, to be decent.

Our pure Italian stocks can be opened at any time and their queens removed, scarcely disturbing the cluster, and, as a general thing, without the use of any smoke at all, by one who is fully conversant with the habits of bees. A good many hybrids will not repel the moth as do the half-bloods and the pure Italians. For these reasons and several others we would rear all queens from one of known purity. If we do this, we may have almost if not quite the full benefit of the Italians as honey-gatherers, even though there are black bees all about us.

The queens, and drones from queens obtained direct from Italy, vary greatly in their markings, but the worker bee has one peculiarity that we have never found wanting; that is, the three yellow bands we have all heard so much about. Unfortunately, there has been a great amount of controversy about these yellow bands; and to help restore harmony, we have been to some expense for engravings.

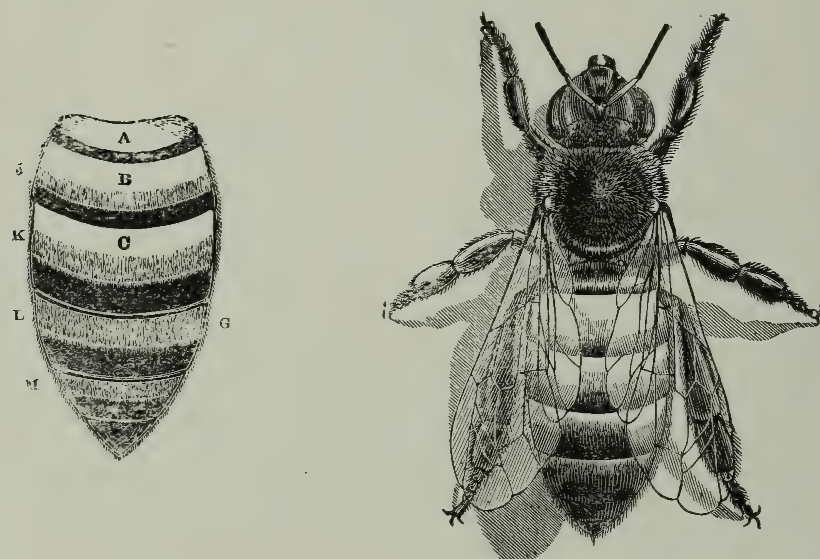
Every worker-bee, whether common or Italian, has a body composed of six tubes, or segments, one sliding into the other, telescope fashion. When the bee is full of honey these segments slide out, and the abdomen is elongated considerably beyond the tips of the wings, which are ordinarily about the length of the body. Sometimes we see bees swollen with dysentery spreading the rings to their fullest extent, and in that condition they sometimes would be called queens by an inexperienced person.

On the contrary, in the fall of the year when the bee is preparing for its winter nap, its abdomen is so much drawn up that it scarcely seems like the same insect. The engraving on the left shows the abdomen of the bee detached from the body, that we may get a full view of the bands or markings that distinguish the Italians from our common bees. Now we wish you to observe particularly that all honeybees, common as well as Italian, have four bands of bright-colored down J, K, L, M, one on each of the four middle rings of the body, but none on the first and none on the last. These bands of down are very bright on young bees, but may be so worn off as to be almost or entirely wanting on an old bee, especially on those that have been in the habit of robbing very much. This is the explanation of the glossy blackness of robbers often seen dodging about the hives. Perhaps squeezing through small crevices has

thus worn off the down, or it may be that pushing through dense masses of bees has something to do with it; for we often see such shiny black bees in great numbers, in stocks that have been nearly suffocated by being confined to their hives in shipping, or at other times. These bands of down differ in shades of color,* many times, and this is the case with the common bee as well as with the Italian. Under a common lens the bands are simply fine soft hair, or fur, and it is this principally which gives the light-colored Italians their handsome appearance. You have, perhaps, all noticed the progeny of some particular queen when they first came out to play, and pronounced them the handsomest bees you ever saw; but a few months after they would be no better looking than the rest of your bees. This is simply because they had worn off their handsome plumage in the "stern realities" of hard work in the fields. Occasionally you will find a queen whose bees have bands nearly white instead of yellow, and this is what has led to the so-called albino bees. When the plumage is gone, they are just like other Italians. Now, these bands of down have nothing to do with the yellow bands that are characteristic of the Italians; for, after this has worn off, the yellow bands are much plainer than before. A, B, C, are the yellow bands of which we have heard so much, and they are neither down, plumage, nor any thing of that sort, as you will see by taking a careful look at an Italian on the window. The scale, or horny substance of which the body is composed, is yellow, and almost transparent, not black and opaque, as are the rings of the common bee, or the lower rings of the same insect.

The first yellow band, A, is right down next the waist; now look carefully. It is very plain, when you once know what to look for, and no child need ever be mistaken about it.

At the lower edge is the first black band; this is often only a thin sharp streak of black.



How to tell hybrids from pure Italians.

The second, B, is the plainest of all the yellow bands, and can usually be seen in even the very poorest hybrids. The first band of down is seen where the black and yellow join, but it is so faint you will hardly notice it at first in some specimens.

We have at the lower edge of the scale, as before, a narrow line of black; when the down wears off, this shows nearly as broad as the yellow band.

When we come to hybrids, we shall find a greater diversity; for while the bees from one queen are all pretty uniformly marked with two bands, another's will be of all sorts, some beautifully marked Italians, some pure black, others one or two banded. Some will sting with great venom, while

* From nearly pure white to a rich orange and down to a brown.—A. C. M.

others with only one or two bands will be as peaceable as your best Italians. Without a doubt, many queens have been sent out as pure that produced only hybrids; but since our recent studies in the matter we are quite well satisfied that we have sold several queens as hybrids that were really full-bloods. A very slight admixture of black blood will cause the band C to disappear on some of the bees,* but we should be very careful in such matters to be sure that the bees in question were really hatched in the hive; for bees of adjoining hives often mix to a considerable extent. If you examine a colony of blacks and one of hybrids that stand side by side, you will find many Italians among the blacks, and many blacks among the Italians. Take young bees that you are sure have hatched in the hive, and you will be pretty safe, but you can not readily distinguish the third band until they are several days old.

FOUR AND FIVE BANDED ITALIANS.

In 1890 and the following year there was quite a rage for four and five banded Italians. These are nothing more nor less than Italians bred for *bands* by selection. For instance, we may take a lot of black fowls, and from one having a few white feathers we can, by selection, breed fowls that are entirely white by selecting the whitest fowls to breed from for successive generations. Some Italians show a tendency toward the fourth band. Perhaps some of the daughters of the mother of these bees will show in their bees a *greater* tendency toward the fourth band. Again, we breed from the last named queen, and select from her another breeding queen whose bees show quite clearly the fourth band with a glimmering of the fifth. By continued selection we may be able to get the fifth. But after all, when we have bees with four and five yellow bands, we are liable to have bees for color and not for business. It is possible to develop any trait that we may wish to have characteristic of our bees. In the same way it is possible to breed bees that are very energetic. But as a general rule we shall have to lose sight of fancy colors.

* Golden Italians of a reasonably fixed type bred to black drones (either Banats or German blacks) produce beautiful three-banded workers of the leather-colored type, and by them the queen would be judged as a pure Italian. But queens raised from them will produce all sorts of bees, even though mated to pure Italian or Golden drones.—A. C. M.

HOLY-LAND AND CYPRIAN BEES.

In 1882 considerable excitement arose over two new races of bees brought over from the Old World by D. A. Jones, of Beeton, Ontario, Canada, who was the leading beekeeper across the line. They were called Cyprian and Holy-Land bees, from the places where he found them. The former, from the Isle of Cyprus, seem to have been for many years isolated, and are a very distinct and uniform race.

While they look like Italians, and might be classed as such by beekeepers not familiar with their peculiarities, yet they have a few distinct characteristics. Holy-Land bees show whiter fuzz-rings, and the bodies are slimmer than those of the ordinary Italians. They are more like the ordinary albinos. In fact, most of the Albinos formerly sold were of Holy-Land extraction. The Cyprians look very much like the four and five banded Italians. The yellow bands are of a deeper orange than those of the Italians, slightly wider, and sometimes more than three in number. Just at the base of the thorax, and between the wings, there is a little yellow spot that is quite distinct and prominent, called the "shield." This is seen on some Italians, but less distinctly.

When Italians are crossed with Cyprians or Holy Lands it is a little difficult to see the difference except by their nervousness.

TEMPERAMENT OF EASTERN BEES.

They are more nervous, especially the Cyprians. Sometimes smoke seems to have no power over them. They will fly up twenty or thirty at a time without warning, and sting the moment they touch the apiarist. The more smoke is used, the more enraged they become. Cyprians especially are the crossest bees ever brought into this country—so cross, indeed, there is scarcely a breeder in the United States who has them for sale. The same objection, though to a less extent, applies to the Holy Lands.

We once sold an imported Cyprian queen; and our customer, after he had kept her for a while, returned her, saying that her bees were so vicious that on one occasion they stung every thing in sight, and drove even the family down cellar. We bought the queen back; but after we had had her for a few weeks and her bees had begun to hatch out we found it would be hardly safe to keep them in the yard. They

would become so enraged at times that the whole colony would rush out in battle array. While the progeny of this queen was exceptionally cross, the general run, both of Cyprians and Holy Lands, is so disagreeable to handle that they are now well nigh discarded in the United States.

The only possible redeeming feature is that they are good brood-rearers; but they breed to excess after the honey-flow, using up all their available stores in raising bees, when Italians would conserve their energies and leave enough honey for winter.

In the matter of rearing queens-cells, either the Cyprians or Holy Lands will rear more queens than any Italians, Carniolans, blacks, or hybrids we ever saw. We have known as many as a hundred natural cells on one frame; and we also had one instance where 25 cells from a Holy-Land queen hatched within a few minutes of each other; and so vigorous were these young queens that some of them actually flew the moment they popped out of their inclosures.

ITALIANIZING. — Few questions are asked oftener than, "How shall I Italianize?" and "When shall I do it?" There is always a loss in removing a queen and substituting another, even where we have laying queens on hand; and where we are to use the same colony for rearing the queen, there is still greater loss. Under the heads of NUCLEI and QUEEN-REARING these points will be found fully discussed. Where one has an apiary of black bees, his cheapest way, especially if he has plenty of time to devote to the subject, is to purchase three or four choice tested breeders, and rear his own queens from them after the honey-flow. He should then put drone-traps on all his black and hybrid colonies, leaving only the Italian drones the freedom of the air.* See DRONES. If the breeders are bought in the spring or summer months, we would not remove the old queens until the summer crop of honey is over; only, instead of allowing natural swarming, take two or three frames from each old stock about swarming time, and make nuclei, giving them cells from the breeding stock.

When these queens are hatched and laying, build the nuclei up, with frames of brood given one at a time until they are full stocks. By such a course you have the full benefit of your old queens during the honey-season, until the new ones are ready to take their places. After the honey-yield has begun to slack you can remove the old queens, and give the now small colonies queen-cells, as you did the nuclei at first. This does the swarming for the season, and the Italianizing, at one and the same time. See INCREASE; also NUCLEUS.

If you have more money than time to spare, and wish to have the work done up quickly, purchase as many queens as you have colonies, and introduce them at any season of the year, as directed in INTRODUCING QUEENS. You can purchase all tested queens if you wish, but we would advise taking untested Italian queens during the months of July and August, when they are the cheapest, as this is also the best time of the year to Italianize. If done in the spring it is liable through change of queens to cut off brood-rearing, and, hence, cause few worker-bees when the harvest comes on. Some find it more convenient to change queens *during* the *swarming* season, first for the purpose of stopping swarming, and, second, because there are plenty of cells usually at this time from choice stocks. See cell-protector under QUEEN-REARING.

After your stocks have all been provided with Italian queens, by either of the plans given above, if you wish your bees to become pure Italians you are to commence replacing all queens that prove to be hybrids, as soon as the young bees are hatched in sufficient numbers to enable you to decide. See ITALIAN BEES. Now, if honey only is your object we would not replace these hybrids until they are one or two years old; for they will average nearly if not quite as good honey-gatherers, and will raise just as pure drones as pure Italians. If you should find the bees of any particular queen too cross to be endurable, replace her with another, at any time. Be careful, however, that these hybrid colonies be not allowed to swarm naturally; for if they raise a queen she will produce hybrid drones;* and this is something we wish most scrupulously to guard against. It will be better to raise all the queens yourself, and make nuclei while seeking to Italianize.

* A better way is to ignore drones and drone-traps, and let the queens mate as they will. Requeen all the colonies with these queens (except the breeding colony), and the next season all drones will be pure, and queens bred from the original mother will find all pure drones.—A. C. M.

* To get rid of black drones, see DRONES.

L

LABELS FOR HONEY.—See Extracted Honey.

LAWS RELATING TO BEES.—Blackstone, the great exponent of common law, says: "Bees also are *ferae naturae* (wild by nature); but when hived and reclaimed, a man may have a qualified property right in them by the law of nature as well as by civil law." And Bracton says: "Occupation, that is, hiving or including them, gives the property in bees; for, though a swarm alights upon my tree, I have no more property right in them till I have hived them than I have in the birds which make their nests thereon, and, therefore, if another hives them he shall be their proprietor; but a swarm which flies from out of my hive is mine so long as I can keep it in sight and have power to pursue it; and in these circumstances no one is entitled to take them. But in respect to such animals as are in the habit of going and returning, as pigeons and bees, which are accustomed to go into the woods and fields, and come again, we have this traditional rule that, if they cease to have the intention of returning, they also cease to be ours, and become the property of the first taker, because they cease to be what are termed *animus revertendi* when they have discontinued their habits of returning."

QUALIFIED PROPERTY RIGHTS.

In case a swarm fly from the owner's hive, his qualified right continues only so long as he can keep them in sight and possesses the power to pursue them where he has a right to pursue, or otherwise positively and distinctly identifies them. The difficulties in reclaiming bees after flight are many. The decisions of our courts furnish numerous peculiar circumstances, and unfold the difficulties in reclaiming bees that have escaped from the hives or soil of their original owner. In the case of Goff vs. Kiltz, 15 Wend, N. Y. 550, the New York Supreme Court held that, where a swarm of bees left the hive of the plaintiff, and went into a tree on the land of another, as he followed the bees and marked the tree into which they went, while he had no right to enter upon the property to recover them without the consent of the owner, yet he could maintain an action of trespass and damage against a third party who did enter the land, cut the tree down, kill the bees, and take the honey away.

REPLEVIN.

Bees may be recovered by the issuance of a writ of replevin.

TROVER.

If the claimant simply requires damages for the loss of the bees, trover is the remedy.

ANIMUS REVERTENDI.

This, Blackstone says, "extends this possession further than mere manual occupation; for my tame hawk that is pursuing his quarry in my presence, though he is at liberty to go where he pleases, is nevertheless my property, for he hath *animus revertendi*. So are my pigeons and bees that are flying at a distance from home, and likewise the deer that is chased out of my park or forest, all which remain still in my possession, and I still preserve my qualified property in them. But if they stray without my knowledge and do not return in the usual manner, it is then lawful for any stranger to take them."

IDENTITY.

It is practically impossible to prove the identity of a swarm of bees in a court of law, even if they possess peculiar characteristics.

TRANSPORTATION.

Though it may be optional with railway companies whether they will accept the full responsibility of transporting bees, yet if they do so without any express restriction they are liable as common carriers. For a

given reward they proffer to become his carrier; for a less reward they proffer to furnish the necessary means that the owner of the bees may be his own carrier; and if the owner and shipper agrees to this arrangement the railway is not liable.

LARCENY.

Bees may be the subject of larceny if they are in some person's possession. Much depends on what constitutes possession; but it is generally assumed the owner of the land is also the owner of the bees (in hives) situated thereon. Bees are likened unto wild animals, belonging to no one so long as they are in their wild state, and property in them is acquired by occupancy, hiving and reclaiming only, and are not the subject of larceny unless they are in the owner's custody, as in a hive or bee-house, or otherwise confined and within control of the possessor or owner.

FINDING BEE-TREES.

The Supreme Court of New York in the case of Goodwin vs. Merrill, said: "A man's finding bees in a tree standing on another man's land gives him no right, either to the tree or bees; and a swarm of bees going from a hive, if they can be followed and known, are not lost to the owner, but may be reclaimed."

RECLAIMED BEES.

If bees temporarily escape from the hive of their owner, who keeps them in sight and marks the tree into which they enter, and is otherwise able to identify them, they belong to him and not to the owner of the soil. In such a case the property draws after it possession sufficient to enable the owner of the bees to maintain trespass and recover damages against a third person who fells the tree, destroys the bees, and takes the honey, notwithstanding the owner of bees himself is liable to trespass for entering on the land of another for similar purpose without authority.

LICENSE.

Where one discovers bees in a tree, obtains a license from the owner of the soil to take them, and thereupon marks the tree with his own initials, he gains no property till he takes possession of the bees, that is to say, he must take them out of the tree.

WHEN BEES ARE OR ARE NOT A NUISANCE.

Strictly speaking, a trade or occupation, a business or industry lawful in itself, and which becomes a nuisance because of its location, or the manner in which it is conducted, or the character of the animals or things is not a nuisance *per se*, though it may be a *prima-facie* nuisance.

Whether bees are a nuisance or not depends on the evidence submitted to the court, and in a broad way it may be stated that bees are a nuisance when the plaintiff can claim damages for injury either for himself or his business.

WHERE BEES MAY BE KEPT.

This has been very clearly decided by the courts. In case of Olmsted vs. Rich, before the Supreme Court of New York, the evidence showed that the plaintiff and defendant were neighbors, the latter keeping a large number of hives of bees in a lot immediately adjoining the plaintiff's dwelling, and at certain seasons they were a source of great annoyance to him and his family, and also that they could be removed without material difficulty to a place on the defendant's premises where they would not disturb the neighbors. The action was in the nature of an injunction to prevent defendants from maintaining their apiary at the place above named. The court held that the case was a proper one for a permanent injunction. In such action the issue was not as to defendant's motive in keeping bees, nor whether he had any knowledge of any vicious propensities of the bees, but simply whether the condition of things as then and previously existing constituted a nuisance. The court held affirmatively, and the bees were ordered removed in order to abate the nuisance.

WHEN NOT A NUISANCE.

The most celebrated case of this kind on record is that of Clark vs. City of Arkadelphia, Arkansas (52 Ark. 23). The evidence in this case showed that Clark, who had kept bees in that city for a number of years, was not in political harmony with those in power, and the latter sought to punish him and get rid of his presence by prohibiting the keeping of bees within the corporate limits of the city. Clark was ordered to move his bees, but refused to

do so, and his arrest and conviction by the city court under the ordinance followed. He appealed to the Circuit Court, the latter dismissing the prosecution, and the State appealed to the Supreme Court wherein it is held that, "Although bees may become a nuisance in a city, an ordinance which makes the owning, keeping, or raising of them within the city limits a nuisance, whether it is in fact so or not, is too broad and is not valid."

BEES MAY BE KEPT IN CITIES.

In April, 1901, the council of the city of Rochester, N. Y., passed an ordinance prohibiting the keeping of bees within the city limits. W. R. Taunton, who refused to remove his apiary, was arrested and brought before a police court. The judge set aside the ordinance and the defendant was discharged. The latter was defended by the counsel of the National Beekeepers' Association.

In the Butchers' Union Co. vs. Crescent City Co. (111 U. S. 746), Justice Fields says: "The common businesses and callings of life, the ordinary trades and pursuits, which are innocent in themselves, and have been followed in all communities from time immemorial, must, therefore, be free in this country to all alike on equal terms. The right to pursue them without let or hindrance, except that which is applied to all persons of the same age, sex, and condition, is a distinguishing privilege which they claim as their birthright." In the same case Judge Bradley says: "I hold that the liberty of pursuit, the right to follow any of the ordinary callings of life, is one of the privileges of a citizen of the United States, of which he can not be deprived without invading his right to liberty within the meaning of the constitution."

It may be well to state in this connection that the National Beekeepers' Association frequently undertakes to defend its members in a court of law where the circumstances warrant the assistance of this influential body.

FOUL-BROOD LAWS.

BEE-DISEASE LAWS; THEIR ENFORCEMENT.

In controlling bee diseases in a community, past experience has shown that it is necessary that every beekeeper do his part; otherwise the work done by individuals is largely nullified by the carelessness or neglect of a few. Where all the beekeepers are progressive, a simple plan of co-operation would be enough; but, unfortunately, there are in almost all communities some beekeepers who are either ignorant, careless, or willfully negligent. If, therefore, they will not voluntarily care for their bees as they should, there must be some legal means of compelling them to abate a public nuisance when disease appears among their colonies. Without such a law for regions where disease exists, progressive beekeeping is difficult and nearly impossible.

Laws providing for inspection of apiaries with the object of controlling disease are, therefore, drafted primarily for the beekeeper who does not voluntarily treat diseased colonies. The progressive beekeeper needs no such law to compel him to do his duty. The inspector of apiaries, however, in actual practice, is much more than a police officer; in fact, his police duties are but a small part of his work. However the law may be worded the good which an inspector does is due in the greater part to his work as an educator. It is the duty of the inspector, specified in the law in most cases, to instruct the beekeepers how to know disease and how and when to treat. The great good which has been done by the various inspectors in the past has been due almost entirely to this phase of their work.

It is, however, most unwise to set the inspector to work merely as an educational officer without any power to enforce his orders. This has been tried, and appears to be a failure. There are, unfortunately, in almost all communities, beekeepers who, from obstinacy or spite, must be driven to their duty. Most men, however, when once they learn that they must treat disease will accept the teachings of the inspector.

The following States and Territories now have laws of some kind providing for inspection: California, Colorado, Connecticut, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Jersey, New Mexico, New York, Ohio, Oregon, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin. Somewhat similar laws

exist in New Zealand, some states in Australia, Ontario, Ireland, and parts of Europe. The beekeepers in several other States are now agitating the passage of similar laws.

These laws may be divided into two groups—those in which the work is done by men employed by the State, and those in which the county authorities may appoint inspectors for the county only. Of these the work by the State officers has proven much more effective. In States where the counties are small, as in the East, county inspection is practically of no value. In States where the counties are small it has been found practically impossible to get competent inspectors in every county; and, furthermore, there is not enough work or enough money available to induce a good man to take the work, unless he is doing it merely for the good of the industry. In the West, where some counties are as large as some of the Eastern States, there is more reason for county inspection; but even in these cases the results are, as a rule, not equal to those obtained in States having State inspection.*

The chief weakness in county inspection is the lack of co-operation among the inspectors in neighboring counties. There is in most cases not only a lack of co-operation, but too often a jealousy between them which results in a loss of co-ordination in the work. This might be remedied by the appointment of a competent State inspector to whom the county inspectors would be responsible; but county officials probably object to the appointment of officers over whom they had no direct jurisdiction. A much better plan would be the appointment of enough State inspectors to do the work (e. g., New York), removing all appointments by county officials from consideration.

A special tax on colonies to bear the expense of inspection is sometimes made. When this tax applies to every beekeeper in the State, no objection can be found to it. The plan of requiring each beekeeper to pay for the work of the inspector in the actual inspection of his own apiary is most unjust, however (e. g., Nebraska). Inspection is instituted for the benefit of all beekeepers in the State, and they should pay for it. To compel the beekeeper who is unfortunate enough to have disease among his bees to pay for work, the object of which is to protect other beekeepers in the community and State, is unwise, unjust, and shows lack of foresight on the part of the framers of the bill.

In nearly all the laws now in force, there is a provision that the beekeeper shall not sell, give away, nor barter honey from diseased colonies. This is a just provision, but seems to be rarely enforced. Inspectors too often hesitate about enforcing it, either from pity for their brother beekeepers or from fear of pressure being brought to bear which will cause their dismissal, or perhaps bring about a repeal of the law. The result is that both diseases are being spread to new localities, and other beekeepers suffer because of this neglect of duty. A beekeeper has no legal or moral right to endanger the property of others by shipping contaminated honey, yet it is being done every year. An inspector who allows this is not only remiss in his duty but becomes party to the crime. Because of this neglect to enforce the provision under discussion, the bee-disease situation in the United States is becoming worse instead of better; and the good done by the inspectors by education seems to be more than nullified by harm done by this neglect.

Inspectors and beekeepers are more careful about shipping diseased colonies to new localities. This is probably because they can see the harm which will result from this procedure more clearly than in the case of shipping honey from diseased colonies. The danger in such cases, while great, is probably much less as a whole than that resulting from the shipping of contaminated honey.

As was pointed out in the discussion of county inspection, the lack of co-operation between the various inspectors is a weak point in our present method of control. While an inspector may now in most cases prohibit the shipping of diseased colonies and contaminated honey to another State, he rarely does so, nor do State inspectors usually report such shipments to each other. If there had been some provision prohibiting interstate shipments of contaminated material, it is probable that we should not now have European foul brood in twenty States, and American foul brood in

* The county law in California is not satisfactory.

practically every State in the Union in which progressive beekeeping is found. If there is no more rigid inspection, our future work on disease control can consist only of the educational work of the inspector. Quarantine regulation will, of course, be valueless when disease is present practically everywhere.

A form of law which, if rigidly enforced, would seem to be the most desirable is given. This must be changed to cover local conditions.

AN ACT FOR THE SUPPRESSION OF CONTAGIOUS DISEASES AMONG BEES IN —— BY CREATING THE OFFICE OF INSPECTOR OF APIARIES, TO DEFINE THE DUTIES THEREOF, AND TO APPROPRIATE MONEY THEREFOR.

Be it enacted, etc.

SECTION 1. In addition to the duties heretofore assigned to him, the State Entomologist (or officer in charge of entomological inspection) is hereby appointed State Inspector of Apiaries, and he is empowered to appoint one or more assistants as needed, who shall carry on the inspection under his supervision.

SEC. 2. The inspector or his attendant shall, when notified in writing by the owner of an apiary, or by any three disinterested tax-payers, examine all reported apiaries, and all others in the same locality not reported, and ascertain whether or not the diseases known as American foul brood or European foul brood, or any other disease which is infectious or contagious in its nature, and injurious to honey-bees in their eggs, larval, pupal, or adult stages, exists in such apiaries; and if satisfied of the existence of any such diseases he shall give the owners or care takers of the diseased apiaries full instructions how to treat such cases as, in the inspector's judgment, seems best.

SEC. 3. The inspector or his assistant shall visit all diseased apiaries a second time, after ten days, and, if need be, burn all colonies of bees that he may find not cured of such disease, and all honey and appliances which would spread disease, without recompense to the owner, lessee, or agent thereof.

SEC. 4. If the owner of an apiary, honey, or appliances, wherein disease exists, shall sell, barter, or give away, or move without the consent of the inspector, any diseased bees (be they queens or workers), colonies, honey, or appliances, or expose other bees to the danger of such disease, or fail to notify the inspector of the existence of such disease, said owner shall, on conviction before a justice of the peace, be liable to a fine of not less than fifty dollars nor more than one hundred dollars, or not less than one month's imprisonment in the county jail, nor more than two months' imprisonment.

SEC. 5. For the enforcement of the provisions of this act the State Inspector of Apiaries or his duly authorized assistants shall have access, ingress, and egress to all apiaries or places where bees are kept; and any person or persons who shall resist, impede, or hinder in any way the inspector of apiaries in the discharge of his duties under the provisions of this act shall, on conviction before a justice of the peace, be liable to a fine of not less than fifty dollars nor more than one hundred dollars, or not less than one month's imprisonment in the county jail, nor more than two months' imprisonment.

SEC. 6. After inspecting infected hives or fixtures or handling diseased bees, the inspector or his assistant shall, before leaving the premises or proceeding to any other apiary, thoroughly disinfect any portion of his own person and clothing and any tools or appliances used by him which have come in contact with infected material, and shall see that any assistant or assistants with him have likewise thoroughly disinfected their persons and clothing and any tools and implements used by them.

SEC. 7. It shall be the duty of any person in the State of —— engaged in the rearing of queen-bees for sale to use honey in the making of candy for use in mailing-cages which has been boiled for at least thirty minutes. Any such person engaged in the rearing of queen-bees shall have his queen-rearing apiary inspected at least twice during each summer season; and on the discovery of the existence of any disease which is infectious or contagious in its nature, and injurious to bees in their egg, larval, pupal, or adult stages, said person shall at once cease to ship queen-bees from such diseased apiary until the inspector of apiaries shall declare the said apiary free from all disease. On complaint of the inspector of apiaries, or of any five beekeepers in the State, that said beekeeper engaged in the rearing of queens is violating the provisions of this section, he shall, on conviction before a justice of the peace, be liable to a fine of not less than one hundred dollars nor more than two hundred dollars.

SEC. 8. The inspector of apiaries shall make annual reports to the ——, giving the number of apiaries visited, also the number of diseased apiaries found, the number of colonies treated, also the number of colonies destroyed, and the expenses incurred in the performance of his duty. He shall also keep a careful record of the localities where disease exists; but this record shall not be public, but can be consulted with the consent of the inspector of apiaries.

SEC. 9. There is hereby appropriated out of any moneys in the State treasury, not otherwise appropriated, a sum not exceeding —— per year, for the suppression of contagious bee diseases among bees in ——. The salary of the deputy inspectors shall be determined by the State Inspector of Apiaries.

SEC. 10. All acts and parts of acts inconsistent herewith are hereby repealed.

SEC. 11. This act shall take effect immediately.

LAYING WORKERS.—These queer inmates, or, rather, occasional inmates, of the hive are worker-bees that lay eggs. Aye, and the eggs they lay hatch too; but they hatch only drones, and never worker-bees. The drones are rather smaller than the drones produced by a queen, but they are nevertheless drones, in every respect, so far as we can discover. It may be well to remark, that ordinary worker-bees are not neuters, as they are sometimes called; they are considered undeveloped females. Microscopic examination shows an undeveloped form of the special organs found in the queen, and these organs may become, at any time, sufficiently developed to allow the bee to lay eggs, but never to allow of fertilization by meeting the drone as the queen does. See QUEENS.

CAUSE OF LAYING WORKERS.

It has been over and over again suggested, that bees capable of this egg-laying

duty are those reared in the vicinity of queen-cells, and that by some means they have received a small portion of the royal jelly necessary to their development as bee-mothers. This theory has, we believe, been entirely disproven by many experiments; and it is now pretty generally conceded that laying workers may make their appearance in any colony or nucleus that has been many days queenless, and without the means of rearing a queen. With Cyprians, Syrians, goldens, and their crosses these laying workers are common, even though the colony has a good queen; and a case is known of a yearling queen in full vigor, a queen a few weeks old and reared in the same colony, and scores of laying workers, all busily laying on the same combs. The stock was Cyprian. Not only may one bee take upon herself these duties, but there may be many of them; and wherever the beekeeper has been so careless as to leave his bees destitute of either brood or queen for ten days or two weeks, he is liable to find evidences of their presence, in the shape of eggs scattered about promiscuously; sometimes one, but oftener half a dozen in a single cell. If the matter has been going on for some time, he will see now and then a drone larva, and sometimes two or three crowding each other in their single cell; sometimes they start queen-cells over this drone larva; the poor motherless orphans, seeming to feel that something is wrong, are disposed, like a drowning man, to catch at any straw.*

HOW TO GET RID OF LAYING WORKERS.

Prevention is better than cure. If a colony, from any cause, become queenless, be sure it has unsealed brood of the proper age to raise a queen; and when this one is raised, be sure that she becomes fertile. It can never do any harm to give a queenless colony eggs and brood, and it may be the saving of it. But suppose you have been so careless as to allow a colony to become queenless and get weak, what are you to do? If you attempt to give them a queen, and fertile workers are present, she will be pretty sure to get stung; it is sometimes difficult to get them to accept even a queen-cell. The poor bees get into a habit of accepting the egg-laying workers as a queen, and they will have none other until they are removed; yet you can not find them, for they are just like any other bee; you may get hold of them, possibly, by carefully noticing the way in which the other bees deport themselves toward them, or you may catch them in the act of egg-laying; but even this often fails, for there may be several such in the hive at once. You may give the bees a strip of comb containing eggs and brood, but they will seldom start a good queen-cell, if they start any at all; for, in the majority of cases, a colony having laying workers seems perfectly demoralized, so far as getting them into regular work is concerned.

It is almost impossible to introduce a laying queen to such colonies; for as soon as she is released from the cage she will be stung to death. No better results would follow from introducing an ordinary virgin; but the giving of a queen-cell, or a just-hatched virgin, if the colony has not been too long harboring laying workers, will very often bring about a change for the better. In such cases the cell will be accepted, and in due course of time there will be a laying queen in place of the laying worker or workers; but often cells will be destroyed as fast as they are given. The only thing then to be done is to scatter brood and bees among several other colonies, perhaps one or two frames in each. From each of these same colonies take a frame or two of brood with adhering bees, and put them into the laying-worker hive. The bees of this hive, which have been scattered into several hives, will for the most part return; but the laying worker or workers will remain and in all probability be destroyed in the other hives. Of course, the colonies that have been robbed of good brood will suffer somewhat; but if it is after the honey season, no great harm will have been done. They will proceed to clean up the combs; and if they do not need the drones as hatched they will destroy them.

See that every hive contains, at all times, during the spring and summer months at least, brood suitable for rearing a queen, and you will never see laying workers.

HOW TO DETECT THE PRESENCE OF LAYING WORKERS.

If you do not find any queen, and see eggs scattered around promiscuously, some

* An almost infallible sign of laying workers is to find a queen-cell with five, ten, or more eggs in it.—C. C. M.

in drone and some in worker cells, some attached to the side of the cell, instead of the center of the bottom, where the queen lays them, several in one cell and none in the next, you may be pretty sure you have a laying worker. Still later, you will see the worker-brood capped with the high convex cappings, indicating clearly that the brood will never hatch out worker-bees. Finding two or more eggs in a cell is never conclusive, for the queen often so deposits them in a feeble colony where there are not bees enough to cover the brood. The eggs deposited by a fertile queen are usually in regular order, as one would plant a field of corn; but those from laying workers, and usually from drone-laying queens, are irregularly scattered about.

LAUREL.—See Poisonous Honey.

LINDEN.—See Basswood.

LOCALITY.—This has a great influence in beekeeping. Many of the manipulations recommended in one locality will not answer for another. A hive well adapted to one place might give indifferent results in another having different conditions. The length of the honey-flow, the time it comes on, whether the nectar comes in a rush for three or four weeks at a time as it does in the East, or whether the flow extends over a period of three or four months, coming in very slowly, are all conditions the beekeeper must study and be able to meet as they are. A slow honey-flow, continuing over a period of four or five months, may require an altogether different hive, or management. It may render the production of comb honey impracticable, for the reason the combs will be travel-stained, and therefore not fit to compete with honey from other localities. On the other hand, a short rapid honey-flow, as in the basswood regions, and where the honey is mainly white, and of good flavor, makes the production of comb honey more profitable than extracted as a rule. Then locality, too, has a bearing on the kind of treatment the bees should receive. If there is no honey after the first or middle of July, and the beekeeper is located in a region where snow falls in winter, and where cold winter prevails for five or six months, he will have to make some plans to keep down brood-rearing after the honey-flow, and arrange to get the bees in the best possible condition for cold weather.* He will probably have to feed, and then in the spring he will be compelled to stimulate brood-rearing to a high pitch as soon as the bees can fly, thus getting the colonies strong at the beginning of the honey-flow. If, however, one is located in the South he must see that his bees have a large amount of stores; for in a warm climate they will consume more than in the North, where it is cold. While the beekeeper of the colder regions tries to prevent his bees from dying during the winter, he who is located in the South endeavors to prevent his bees from starving until the next honey-flow.

THE BEST STATES FOR KEEPING BEES.

We are very often asked the question as to the best location in the United States for keeping bees as a business. We usually advise the inquirer to stay right where he is. While beekeeping in good seasons may be very profitable in California, yet experience has shown that the honey-producers of the Golden State have only one good year in from three to five. Taking every thing into consideration they do not average any better than their brethren of the East where the market is certainly better. Colorado, Arizona, New Mexico, Utah, Idaho, *in the irrigated portions,* sometimes show wonderful results in honey; but in all the States named, where the bee-range is at all good, the country is overstocked with bees and beekeepers, and one can scarcely get into one of the places without buying out somebody already in the field.

Texas as an all-around bee proposition is one of the best bee States in the Union. It is not over-populated yet, and there are very many desirable bee-ranges within its borders. The same may be said of Idaho and Utah. Kansas and Nebraska are good bee States, having usually good fall flows; but sometimes either or both have fearful drouths that kill down nearly all vegetation, rendering farming as well as beekeeping, for that season, almost a failure. Among the eastern States, New York is one of the best because it has, in addition to clover and basswood, immense acreages

* A strain of bees left to themselves will gradually change their habits to fit the environment. By observation and selection the beekeeper can do much to hasten this—A. C. M.

of buckwheat, which on those hills yields immense quantities of honey. Wisconsin and Minnesota were formerly good localities for basswood; but that desirable tree for timber as well as honey is now being rapidly cut off, and the main stay will be, as with the other States, white clover, with a large sprinkling of sweet clover along the roadsides and railways. Most of the north-central States have conditions that are practically the same, reaching away from Minnesota to Maine, and continuing down the Ohio River and Chesapeake Bay. While the amount of honey secured in these localities is less per colony, the price it brings is higher, because in this portion of the United States the centers of population are located. Throughout the South, east of the Mississippi, the honey secured is very good, mostly extracted, and the flow covers a long period; but the quality is not quite equal to the honey of the North.

LOCUST (*Robinia pseudo-acacia*).—Variously called common locust, yellow locust, white locust, black locust, and false acacia. This is one of the fine honey trees of the country. It belongs to that great family of *Leguminosae* which embraces so

Common locust.

many of the best honey plants such as the clovers, acacias, vetches, peas, beans, etc. It is a native of the mountains from Pennsylvania to Georgia, but has become naturalized in many parts of the country. Large plantations of it have been made for timber. The wood is hard and very durable, and is much used for posts. There is a saying that stone will crumble before locust will rot. The tree grows to great size and is long lived except where attacked by borers. It spreads rapidly by sprouts rising from the roots which run for long distances near to the surface. Where the trees are cut or killed by borers the roots send up quantities of sprouts which grow very rapidly and flower freely within two or three years.

The white and fragrant flowers are like pea blossoms and are in pendant clusters like those of wisteria. It blossoms in May and June, remains in bloom for a week to ten days and yields an immense amount of a water-white honey, of heavy body and mild flavor. There are two other locusts; one, the *R. viscosa* (*clammy locust*), is similar to the above, but flowers are tinged with pink and are inodorous. It is native from Virginia to Georgia. It has been introduced in the North where it seems perfectly hardy. The other, *R. hispidia* (bristly locust or rose acacia), is a shrub growing from three to ten feet high. The stems are covered with bristles, hence the name. The flowers are produced singly, are large, of a deep rose color, and inodorous. It is a native in the mountains from Virginia to Georgia. It has been introduced and become established in the North. It is of no particular value as a honey plant, but is very beautiful.

The honey locust (*Gleditsia triacanthos*) gets its common name from the sweet honey-like pulp in the seed pods, and not from its production of honey. The inconspicuous greenish flowers are produced in small spikes and last only a few days. It is of little consequence as a honey plant. The tree is native of rich woods from New York to Texas, and has been introduced in many other places.

LOGWOOD (*Haematoxylon campechianum*).—A tree found in the West Indies and Central America. It is primarily a dyewood. The dye is extracted from the heart of the tree. In its early stages, this heart is only a small colored core; but as development continues, it enlarges, until in full maturity there is but little sap between heart and skin. The dyewood is prepared for shipment by digging up the tree, roots and all, chipping away the outer sap, thus leaving the colored core ready to be rendered into dye.

There are large areas in the tropics where this tree is the predominating growth. When the full bloom is on, many

square miles of country become suffused with the mellow beauty of its golden blossoms, the delicate and pleasing perfume of which is everywhere paramount. We know no finer honey than that of the logwood blossom. It is almost water-white, very dense, and possesses a peculiarly pleasing flavor—in fact, it seems to embody the primal fragrance of the bloom.

In Jamaica logwood is the principal source of honey. This is true both as regards quality and quantity. You may usually count on two main flowerings—one occurring in November, and the other about Christmas time. The first is not so much to be depended on, as it is usually light, and besides there are about that time other honey sources productive of inferior quality—"bitter bush" for instance—so that the finished combs held up to the light reveal a patch-work of various colors. Even in extracted honey, it is almost impossible to effect a separation. This mixed flow, however, is peculiarly valuable as it enables the beekeeper to fill his broodnest and catch the main logwood flow in the supers.

The second or main flow occurs about Christmas, and may last all through January. Here lies the hope of the apiarist. Two factors then contribute to his crop. The first is the condition of his colonies. They must be ready, or the finest of the year goes to brood and brood-combs. Even if barrels of sugar have to be fed, a super should be on every hive, and bees in the supers by the middle of December. This done, the beeman's end has been accomplished. But there is another factor: Rain. We have watched the great strings of buds drooping heavy downward, and while forests beaded with folded blossoms all ready to burst—one factor was missing—rain. We have seen, while full apiaries waited, the untempered torrid sun burn the blossoms into crumbled dust. But, let the rains fall at the proper juncture, and thousands of acres burst into fairyland. We have seen evenings when everything looked hopeless. That night a shower fell. At daybreak the apiary was a-roar, and the clear atmosphere was black with bees. Of course, the duration of the principal bloom is also dependent upon light intermittent showers. There have been seasons when the main bloom lasted for six weeks, and individual colonies made as high as five hundred pounds.

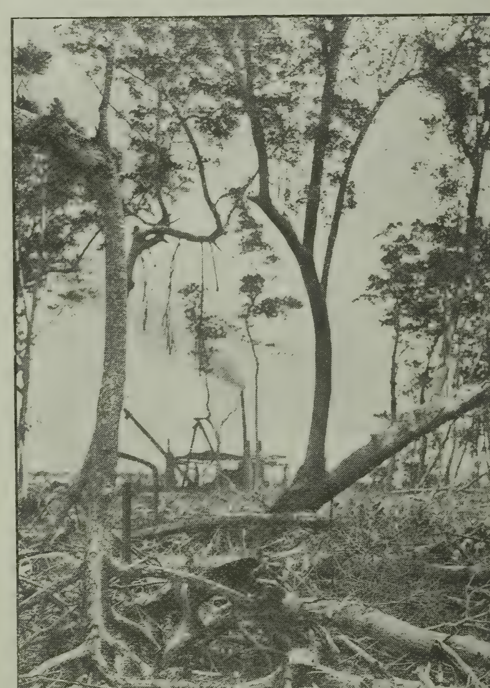
Is there no danger of the logwood forests being depleted? Hardly, unless by intentional transfer of industry. The tree grows of its own accord, and the growth is so abundant that the planter, so far from planting trees, has to thin out the yearly natural propagation. Otherwise the logwood estate needs little attention. The main expense is to prepare the mature stock for market, and this consists in paying laborers so much per ton for "chipping." Owing, however, to the rapid introduction of aniline dyes, the logwood industry is being supplanted by others that are more profitable—such as sugar-cane, bananas, etc. But where a genuine logwood estate can be found, the beekeeper can afford to establish apiaries of some five hundred colonies, depending on the main crop, which will yield abundant pasturage for that number, and pay little attention to the blooms from other sources.

LUCERNE. See ALFALFA.

M

MAGNOLIA (*Magnolia grandiflora*) or laurel bay.—The noblest tree of all the magnolia family grows to a height of forty feet in its native habitat, the deep hammocks, straight and heavily branching. The leaves are dark, rich green, smooth and glossy on the upper side, of a rusty-velvety nature below. The blossoms are the crowning glory. They are large and showy, like huge creamy-white saucers, gradually turning brown as they mature and fade. They are rich in pollen, and the bees become fairly steeped in the dust as they gather the nectar from the stiff yellow stamens at the center of the white saucer-like flower. An analysis of samples of honey sent to the government experts at Washington, from the vicinity of DeLand, Fla., always reveals the presence of pollen grains from the magnolia, showing that it is a good yielder of honey. It comes along with holly, and often with scrub palmetto, so that it is never secured alone. Even back from the hammocks it is extensively planted for shade and avenue trees, and the number of these trees used for ornament is so large that they make considerable showing in the activity of the bees in localities that would not otherwise feel their influence.

MANGROVE, BLACK (*Avicennia nitida*).—Never in the history of honey-producing plants has any single source yielded the results or attracted the attention of the public as has the black mangrove of southern Florida. Of the vervaine family, the black mangrove is an evergreen maritime shrub or tree—shrub in northern limits, tree further south. It flourishes best on the small islands and keys that fringe the shore on both eastern and western coasts, where the salt water keeps its feet seasoned with brine, though not necessarily under water. It does not grow much north of the 29th parallel—that is, about the range of Ormond, on the east coast. It needs to be kept distinct in mind from the red mangrove (*Rhizophora mangle,* S.), and the white mangrove (*Laguncularia recemosa,* S.), whose habitat is similar to that of the black mangrove, only it does not need salt water to flourish. The white mangrove belongs to the pomegranate family, and is also called buttonwood, which see. The black mangrove, when a tree, much resembles a scraggy old oak tree, the bark being a gray hue and the surface rough and uneven. It attains a trunk diameter of four feet at its best, and even greater in the extreme southern portions



Black mangrove on the right; red mangrove on the left.

of the State and on the Keys. It usually grows back of the red mangrove, if both grow together, the red being a soil gatherer, on the fringes and shell reefs, and the black forming soil back of that. Both are valuable in this particular of catching drift and lodging humus and gradually transforming the shallows into reefs and islands, and ultimately into solid earth.

It does not, like the red, require a sea-bath every day, but must have salt water in the subsoil. The leaves are short-stemmed, fuzzy in appearance when young, soon becoming smooth and tough. The shape is oblong, a little larger just above and below the middle. The leaves are bright green above, pale beneath, speckled with fine specks that gleam with a peculiar metallic glint. The flowers are inconspicuous, of a yellowish-green hue, blossoming on a spike or head, the same flower-stalk carrying both old and new blossoms at the same time. This peculiarity lengthens out the bloom-period very considerably, which lasts from six to eight weeks in most favorable seasons. The wood closely resembles ebony in color and weight, and, when used as fuel, makes an intense heat and burns with a peculiar crackling sputter. The stove-door must not be tightly closed in burning the wood or it will not burn steadily. On the small islands thick set on the Indian River, and even further north, along the east shore of Florida from Ormond south, are thousands of acres of the black mangrove, now from six to ten feet high, shrubs of considerable size. This is the paradise of beemen, or was before "the freeze" of 1894. But if the name is "black," the honey is white. It is the whitest honey in Florida, with perhaps the single exception of cabbage palmetto. The body is rather thin, though better in that on the Keys than on the mainland. In flavor it is very sweet and mild, and has just the barest suggestion of brakishness about it, due either to the soil or the vicinity of the salt marshes. The brakishness is not at all objectionable. The honey is usually pronounced first class, and ranks with the four best honeys of Florida—namely, the white tupelo, the orange, the scrub palmetto, and the mangrove. Up to the year of the "big freeze" in 1894 it was without exception the greatest yielder of honey of any plant or tree in the world. As much as 400 lbs. from one hive in one season from black mangrove has been recorded. The severe cold of the year named froze down all the mangrove on the coasts, and it has taken them 18 years to recover. They are now coming into bearing or yielding again, and there seems no reason why they should not become as great producers again as they were before. It began to yield honey again in small quantities first in 1909. Since that time the bushes have been increasing in size, and the yields have grown also, though it has not yet shown any thing like its former secretion. Like most sea-coast yielders it seems very sensitive to temperature and humidity changes and conditions. In 1911, for example, in the vicinity of the 29th parallel it started in to yield well, and all seemed prosperous. The bees began to show their old-time zeal, leaving their hives for the marshes almost before dawn, and lingering there till after dusk, roaring across the intervening coves incessantly, but after about two weeks of such work, weather conditions suddenly altered, and hardly a bee was seen again on the blossoms, although they continued to grow and fade as before. When conditions are just right the honey can be seen in large drops, shining in the tiny cups, and a bee can load up from a single blossom. Overstocking could never be a bugbear in a mangrove section if conditions were just right. The cabbage palmetto usually blooms at the same time as the black mangrove, so that the two honeys usually blend. See PALMETTO, CABBAGE. In earlier days "migratory bee-keeping" to the vicinity of Hawks Park was practiced from many points up and down the coast, and from inland localities, from fifty or more miles distant. The severe cold weather of one or two years put an end to that practice. Whether or not former conditions will return remains to be seen.

MANIPULATING FRAMES.—See FRAMES, HOW TO MANIPULATE; also REVERSING.

MARIGOLD (*Gailardia pulchella*). This is found all over the United States, but, so far as we know, it does not yield any great amount of honey except in Texas, where it is considered one of the main honey-producing plants. It begins to yield in May or June, giving a rich golden honey. While it is praised greatly by many connoisseurs in the South, it would not rank well with clover and basswood of the North. The comb honey is golden yellow, not white.

MARKETING HONEY.—See COMB HONEY, HONEY PEDDLING, EXTRACTED HONEY, and SHIPPING CASES.

Marigold, great honey-plant of Texas; but found all over the United States.

MESQUITE (*Prosopis glandulosa* and *Juliflora*).—A leguminous tree common in Southern Texas, New Mexico, and Arizona, and important in old Mexico, more particularly in Sonora, where it grows to the dignity of a fine timber tree in the valley of the Yaqui River. Growing in a semi-arid country it is always possible to get a yield of honey from the mesquite except where it grows so far north that the cold injures it. In Uvalde Co., Texas, it is looked on by the beekeepers as a great tree for honey. There, it is little more than a shrub; but further south in Mexico, around Monterey, it becomes of far more economic importance. The Texans class the mesquite honey high; but we should be inclined to rate it second-class among the ambers. There are several species of mesquite, but the foregoing is the one usually referred to by beekeepers. The others are probably equally good for honey.

"One of the main sources of nectar," says L. H. Scholl, "for the Texas beekeeper is the mesquite brush and trees that cover a very large area of the Lone Star State. As unimportant in appearance as this bushy tree is, it is of greater importance to the beekeeper than most people suppose."

The mesquite (pronounced *mes*-keet) has two separate and distinct blooming periods during the year. The first comes during April, and the other during the end of June or the beginning of July. These periods are sometimes a week or so earlier

Mesquite leaf.

or later, according to the conditions of the season, the lateness or earliness of the spring, cold weather, and the quantity of rain during the preceding fall and winter. In this last respect the mesquite is peculiar in that, if rain has been plentiful in the fall and winter, no matter how dry the following spring or summer may be, there will be a profusion of bloom and a heavy flow of nectar. This is due to the character of the plant, in that it stores up sap, as it were, from which it is enabled to put forth its growth, and also that its roots penetrate the soil to a great depth, spreading out quite a distance in the soil. It is remarkable how a very small shrub of the mesquite is supplied with these large roots in proportion to its size. It shows at once that it is well adapted to a dry region.

The quality of the honey is good, and of a light-amber color. It has been said many times that mesquite honey could be used better for an every-day table honey than any other of the Texas honeys, since one never tires of it, as he is apt to do of honey that has a particular flavor.

The long spikes of feathery blossoms measure from three to five inches in length. When the second blooming time arrives, the beans from the first blooming, which are from six to eight inches long, will be in all stages of ripening. These are greedily eaten by all kinds of stock and cattle, and are of considerable value in this way. Even human beings find that these beans have a good taste, and children particularly relish them each season as they ripen. They vary considerably, however, in taste, some being so bitter that they can not be eaten, while others are very sweet and agreeable. The wood of the mesquite is valuable for furniture and cabinet work, as it takes a fine polish, and mesquite posts are used very extensively.

METAMORPHOSIS OF BEES.—See Development of Bees.

MIGRATORY BEE-KEEPING. — Experience has shown that the secretion of nectar in a given locality varies sometimes, even within a distance of only a few miles. For example, it will happen that the home-yard bees will be gathering no honey when an outyard eight or ten miles away will be securing a fairly good crop. This is due to the fact that the character of and moisture in the soil makes possible the growth of some plants that will not take root in other locations only a few miles away. For example, a bee-yard may be situated in a valley close to a stream, along which there will be a heavy growth of honey-yielding plants. Within a few miles from there, perhaps on higher ground, and soil less productive, there will be nothing.

Sometimes we find conditions like this—in one locality a large amount of buckwheat will be grown; ten miles away from there, there will be none whatever. The same is true of red clover, alsike, and a number of other artificial-pasturage crops.

Again, it will happen that in one year when there is an excess of rainfall the location in the valley will be too wet for the proper growth of plants yielding nectar, while on the higher ground, a few miles away, conditions will be just right for a fine flow of honey.

The knowledge of these varying conditions in localities only a few miles apart has led some beekeepers to practice what is known as migratory beekeeping. For example, in one yard it is evident that bees are not getting any honey, and there is no flora of any sort that gives any promise of any. On the other hand, there is another yard that is doing well, and there are still other locations without bees where there are immense quantities of alsike or red clover, or of buckwheat. Evidently it is a part of wisdom and business sense to move the yard that is yielding no returns to the location in which the honey can be secured.

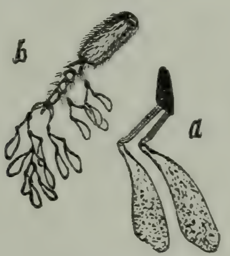
While migratory beekeeping is not practiced to any considerable extent in this country, largely because of the expense of moving, yet there are some sections in the country that make the practice exceedingly profitable. In Germany migratory beekeeping is carried on somewhat more extensively than in this country, and occasionally we hear reports of a whole bee-yard being put on an immense raft on a river. This raft is secured near the shore, and when the honey crop is taken the raft is let loose, when the raft, bees and all, are towed to pastures new. These floating apiaries have never been much of a success. Too many bees appear to drop in the water and drown. Mr. C. O. Perrine, many years ago, tried out this experiment on the Mississippi River, but the experiment was a financial failure. For further particulars see Moving Bees, sub-head "Shipping Bees in Carlots."

MILKWEED (*Asclepias Syriaca* L.); also known as silkweed from the tuft of long silky hair on the seeds. While *A. Syriaca* is perhaps the most common species of milkweed, there are 21 others in north-eastern America, and about 25 more in the southern and western States. In California, *A. Mexicana* Cav. is the species of most interest to beekeepers. The flowers are small, and many of them are aggregated to form a flat-topped flower-cluster; while in color they are green, white, yellow, red, or purple, but never in our species blue. They are called pinch-trap flowers because they possess a remarkable clip mechanism found in no other family of plants in the world.

The way in which the pollen-masses are clamped to the feet or legs of insects is of much interest to beekeepers, and every

season there are many inquiries in regard to this queer phenomenon. The five anthers stand close together, forming a sheath around the stigma. Each anther is provided with two lateral wings, and where the wings of two adjacent anthers touch, there is a narrow slit, larger at the base than at the top. The anther, it will be recalled, usually consists of two sacs containing the pollen. But in the milkweed the grains of pollen are not separate, but are bound together in waxy flattened masses called pollinia. Two of these pollinia, or club-shaped masses of pollen, belonging to two different anthers, are attached by flexible bands to a small dry membrane, or disc, midway between them. In this flat triangular disc there is a wedge-shaped slit at one end. The disc stands directly back and above the slit between the two anther wings. This is the pinch-trap ready for action.

Let us now observe what happens when a bee alights on the flower in search of nectar. In its efforts to obtain a foothold



Pollen of the milkweed attached to a bee's foot.

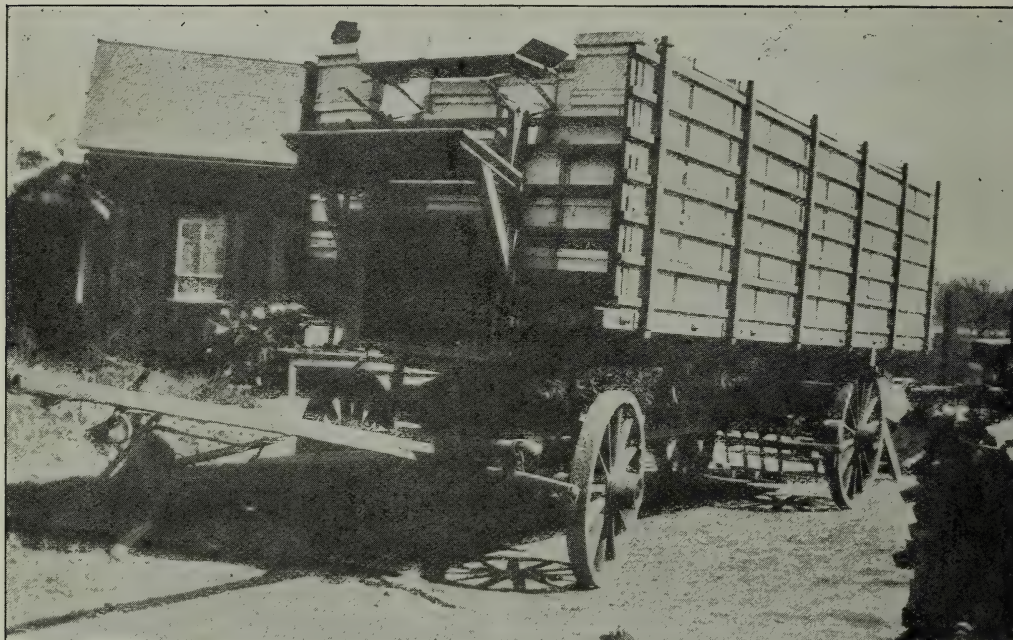
on these small smooth flowers it thrusts a claw or leg into one of the slits between the anther wings. Presently its leg is drawn upward into the wedge-shaped slit in the little membranous disc, which soon becomes firmly clamped to its leg, or in some cases to one of its antennæ. The harder the bee pulls, the tighter does the little pinch-trap hold. When it flies away to another flower the pollen masses which, as described above, are joined to the little disc by straps, are forcibly torn from their pouches. Exposed to the air the strap-like stalks dry and draw the pollinia close together. Then as the bee alights on another flower they are easily thrust through the slit between two of the anther wings; but once inserted, and the insect's leg drawn upward, they can not again be withdrawn. The bee can obtain its liberty only by breaking the connecting bands. If this happens, the pollen masses are left in a chamber near the stigma, and the bee bears away the membranous disc with its empty stalks. Disc after disc may thus become attached to an insect until it is crippled or helpless.

It is stated on the authority of Gibson that one season an English beekeeper lost thousands of bees from the effects of strings of these clips. It was at first supposed that they were being destroyed by a fungus. Many different explanations have been given of these curious structures by persons not familiar with the flowers of the milkweed. Some think them a parasite, others a protuberance growing on the bee's foot, and others a winged insect enemy of the bee. We give here an engraving of the curiosity, magnified at *a*, and also a mass of them attached to the foot of a bee. If the insect is not strong enough to pull out the pollinia, or later to break the connecting bands, then it perishes slowly and miserably of starvation. These dry membranous discs are often described, even in botanical works, as glands, or as being glutinous or sticky, but this is never the case.

It is the same plant that Dr. Riley alluded to when he recommended that the milkweed be planted to kill off bees when they became troublesome to the fruit-grower. The folly of such advice—think of the labor and expense of starting a plantation of useless weeds just to entrap honeybees—becomes more apparent when we learn that it is perhaps only the old and enfeebled bees that are unable to free themselves from these appendages, and hence the milkweek can scarcely be called an enemy.

MOTH-WORMS.—See BEE-MOTH.

MOVING BEES.—Young bees, when they first start out, or old ones on the first flight of the season after a winter's confinement, hover in the air about the hive-entrance, take a careful survey of surroundings, making wider and wider circles, each time taking in new objects by which they may familiarize themselves with the home. When the location is once carefully marked they will go back and forth without taking any note of distinguishing objects. But when the hive is moved only a few feet



Rack made in California, especially for hauling bees.

there is apparent consternation and confusion.

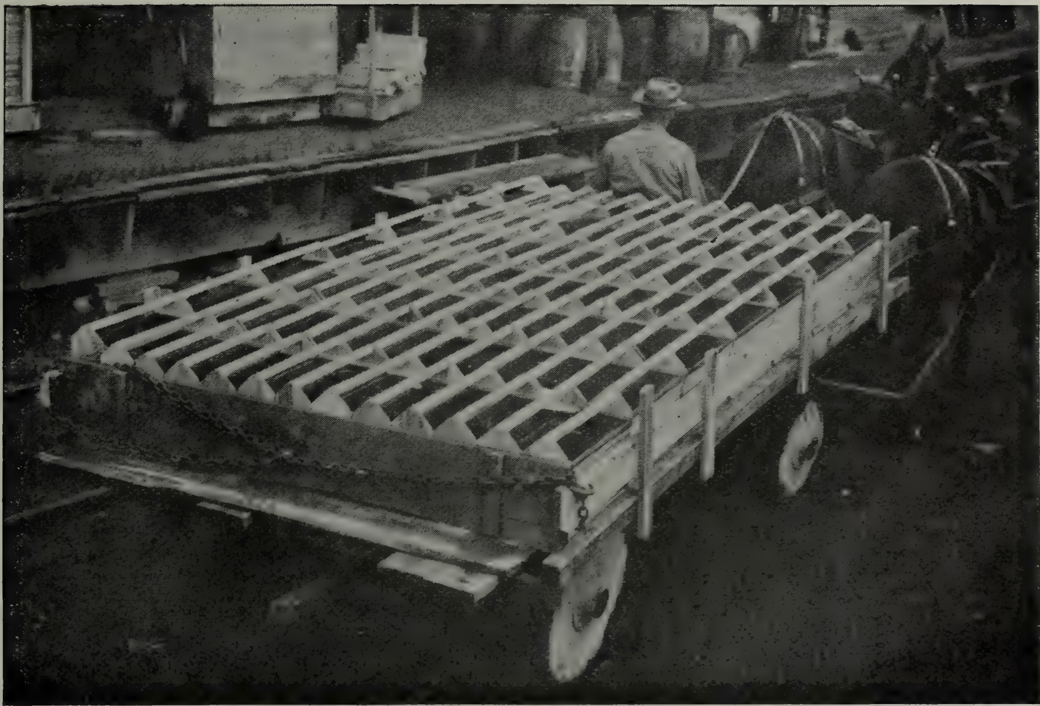
One can not, therefore, move his bees a few feet or a quarter of a mile without having the great majority of them go back to the old spot unless treated by the plans we shall describe. They would perish, or possibly get into some other hive near their old location, with the result that there would be a fight, and many bees killed.

If one desires to move his bees, and wishes to take them at least a mile and a half or two miles away, the problem is quite easy, for then they will stay wherever they are placed. As soon as they are liberated in their new position they will mark the location as thoroughly and carefully as when taking their first flight. After that they will go to and from the same spot as if it had always been their home.

But to move our bees from the front to the back yard, or, we will say, from a fourth to half a mile, is not so easy. They are familiar with the whole range of flight within a mile of the old stand; and when they go over their old hunting-ground, so to speak, instead of returning to the hive from which they have just come they will return to the old location. How, then, shall we make them stay where placed? One way, and the very best one, is to wait till fall or winter. After they have quit flying for the season, move them to the spot desired. If they are confined for several weeks by cold weather, or longer, they will mark their new location and go back to it as their regular and permanent home. It will be better still if they can be confined for several months in the cellar; then when they are put out again in the spring, place them in the new location; for it is well known that cellared bees can be placed anywhere the following spring without reference to their old stands. Wherever they are placed they will mark their location, and that must be their fixed position for the season.

But suppose it is the midst of summer, and for some reason the bees must be moved a few rods from their old location. Perhaps complaint is made that the bees in the front yard are interfering with passersby, and to avoid trouble it seems desirable to move them to the back yard. In an emergency of this kind the following plan may be used:

Tack wire cloth over the entrances, carry the hives down cellar, and keep them there for at least five days, and longer if they appear to be quiet. While the bees are in the cellar, change the surroundings in the front yard or in the old location as much as possible. After the bees have served out their allotted time of confine-



Wagonload of 91 nuclei *en route* to the Basswood yard. A low-wheel wide-tired wagon is just right for loading and unloading, and for carrying bees from one yard to the other. The wide tires make it possible to get over soft sod when the ground is wet. We use this wagon with the team. We also have a light spring wagon and a horse for small loads.

ment, put them in the back yard in the same order as before if it can be done conveniently. While some of the bees may, perhaps, go back, the great majority will stay in their new location. Those that do return should be given a frame of brood in a hive; and when they have clustered on it take them to the new location and dump in front of the entrance to the hive. If the bees are confined during cool or rainy weather, when they can not fly, there will be no loss of honey that might possibly be gathered from the field; but while the bees are confined in the cellar, keep a watch on them to see that they do not suffocate; and, if practicable, cover the whole top of the hive with wire screen.

There is still another method; and wherever it is practicable to carry it out we would recommend it in preference to carrying them into the cellar; that is, move the bees to a point a mile and a half or two miles from the old location. Let them stay there two or three weeks, then move them back. But this involves considerable labor, so that the average person would not think it practicable.

Another plan that has been spoken of very favorably, and possibly may be better than any of the others mentioned heretofore except the plan of moving to an outyard and then moving back again, is this: In the cool of the morning, *at a time of year when no honey is or has been coming in,* colonies may be moved a few feet or a few rods with very little trouble. The hives are put on a wheelbarrow early in the morning, and trundled as roughly as possible after smoking at the entrance clear over to the new location, for it is important that the bees get a general shaking-up in moving. If the frames are self-spacing there will be no damage done to the combs nor to the bees. The hive is set down on its new stand, when it is given a little more smoke. Any number of colonies can be moved in this way; but the moving should be all done at once, and the old location should be changed in appearance as much as possible. Very few bees will go back when so treated. We have tried it in a limited way, and found that it works admirably. But right here a caution must be entered. Do not attempt to move bees a short distance when a honey flow is on or has been on for two

The Root Company's men ready to move bees to one of the outyards.

or three days. When bees have been going regularly to the fields for a number of days they get their location well fixed, and it is almost impossible to move them at such times short distances without a general returning of field bees to the old stands. One of our correspondents reported that he attempted to move bees to a neighboring lot when the honey flow was on, and he says he never saw bees crosser in his life. When, therefore, a neighbor of yours complains that your bees are interfering with public traffic along the highway, and that you will have to move them at once, you must take into consideration whether there is a honey flow on. If so, explain that moving bees at such times will only make the trouble complained of much worse. See Bees as a Nuisance; also Apiary.

We have tried another plan that has given good results; but this, like the other, must not be attempted when a honey flow is on. Move the hive a few inches a day, and each time make a bigger jump than the one preceding. After the bees have been moved in this way from two to five times they learn to *expect* a change in location, and therefore will hunt out their hive wherever it may be. Sometimes in such moving it is advisable to put up a board against the entrance just after moving, in order to arrest the attention of the bees when they come out. This forces them to mark their location anew.

Whatever plan is used, we would recommend trying the one that gives the best results. Ordinarily we would advise, as a matter of convenience, moving the bees in the cool of the morning, when no honey flow is on, giving the bees as much of a shake-up as possible, but of course not violent enough to break the combs.

HOW TO MOVE BEES A DISTANCE OF SEVERAL MILES.

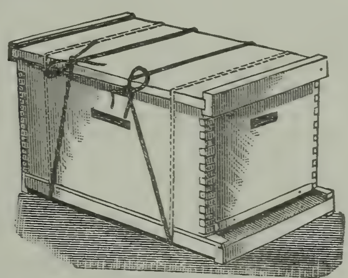
The remarks that have been made heretofore apply to moving bees only a short distance; but when they are to be carried a considerable distance, and jolted over rough roads, the bees require more ventilation than can usually be afforded by an ordinary entrance. If they are shut up during the middle of the day, those in the field are liable to be lost. Ordinarily they should be confined at night or in the early morning —better at night.

If you wish to move bees during the daytime, while many are in the fields, you can get them nearly all in by smoking them at intervals for about half an hour. This will give those that are out time to come in, and the smoking will prevent any more going out. If the colony is very

Moving bees by boat.

strong, leave a hive with a comb of brood on the old stand, and the owner can start a nucleus very conveniently with the returning bees.

Many beekeepers fasten the bottoms to their hives permanently, so all that is necessary in such cases is to secure the cover and put a wire-cloth screen over the entrance. A very good plan is shown in the next engraving, consisting of two cords or ropes.

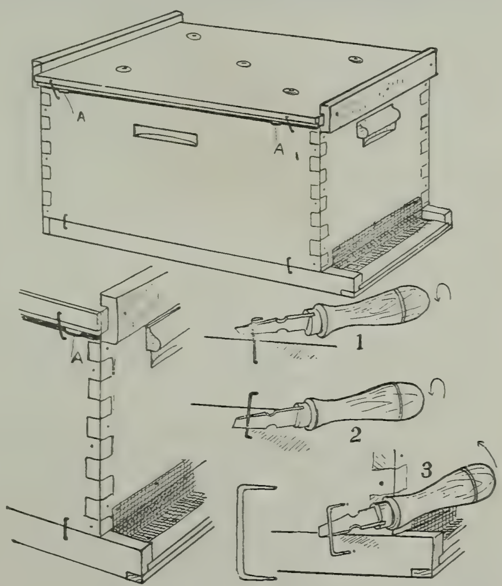


Fastening bottom-board and cover.

One rope is drawn around as tight as possible at one end, and the other is put on the other end. The cords are then drawn together at the top in such a way as to produce a strong tension.

Another plan, somewhat similar, is to use one cord or rope. It is drawn around the hive, and tied loosely. A stick is then slipped into the cord and given a half-twist in such a way as to draw the loop up very tight.

But by far the most satisfactory plan, certainly the safest, and the one that we adopt in our moving, is that of using a special staple (obtained at the hive-factories) shown in the accompanying illustrations. One leg of the staple is driven into the bottom-board, and the other into the hive-body. One staple on each side and



one at the rear will be sufficient to hold the bottom-board. For the cover there should be four staples—two on each side.*
The staples are very easily removed with

* All our bottom-boards are permanently fastened in this way, and when necessary the staples can be removed without turning the hive upside down to remove nails.

a screwdriver at least a foot long, if they are not driven down too tight. The tool is shoved under one side, close to a leg of the staple, and given a quarter twist, and then it is moved over to the other

Under way.

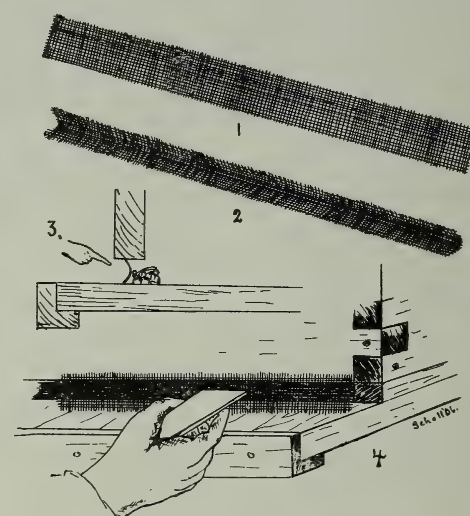
side, and twisted again. When the staple is raised high enough so the screwdriver can get under and give it a good pry it can be easily removed.

TO PREVENT BEES FROM SMOTHERING.

Provision should be made to prevent the bees from smothering. Even in the hottest weather we do not now use wire-cloth screen on top, because we move either early in the morning, toward night, or during the night. Four pieces of wood about ½ inch wide, and not more than ⅛ inch in thickness, are put between the cover and the hive at the four corners. The staples are then driven in, leaving a gap of ⅛ inch between the hive and cover. This, together with the entrance-screen, usually affords sufficient ventilation providing one does not have to be too long on the road. But even in that case one can prevent smothering the bees by dashing a pint of water over the entrance-screen. This will drive the bees from the wire cloth when smoke would not. Smoke, on the other hand, would only tend to aggravate the trouble, whereas water affords instant relief. It cools the bees and drives back those that are shutting off ventilation.

If the water does not succeed in keeping the bees from the wire cloth, remove the screen and let them come out. If the hives have been jarred at least half a mile on the journey there is very little fear of their flying out.

For closing the entrance nothing is simpler and better than a plain strip of wire cloth as long as the inside length of the entrance and two or three inches wide.



This is bent at right angles lengthwise, and then pushed in the entrance, in the manner shown, so that it wedges fast. On arrival at destination the wire cloth can be quickly jerked out.

In moving our bees to outyards we generally use a two-horse team with an ordinary hay-rack. Hives with bees are put on the bottom; those on top are only empties. One should take along a quantity of rope, a hammer, tacks, screwdriver, and a lighted smoker. Be sure it does not go out on the road. A little smoke at *just the right time* may save the lives of valuable horses, a whole load of bees, and possibly the life of the beekeeper and of the driver as well. While on the route, be sure to give the smoker a "whiff" or two to make sure it is still going. We would also carry along a pail of water and a big sponge. If any of the colonies seem to be suffering from lack of ventilation, dash a little water

over the wire screen. As a general thing, avoid moving bees by day during very warm weather. Do it at night, when the atmosphere is a little cooler.

MOVING BEES BY WAGON WITHOUT SHUTTING THEM IN THE HIVE.

A few say they have been successful in hauling bees from one location to another without putting on entrance-screens nor screens on top of the hives. At first thought, to one who has never tried it, such a plan would not only seem unwise but foolhardy—dangerous to the driver and dangerous to the horses. But it seems it has been done without any bad results. If screenless bees can be moved without danger it means the saving of a lot of work in putting on screens, and, what is of considerably more importance, it entirely eliminates all danger of suffocation. It should be remembered that bees will not smother to death unless they are confined within the hive. When a colony is very populous, and the only means of ventilation is through a screened entrance, the bees next to this entrance will crowd tighter and tighter against the wire cloth to get better air, practically sealing the entrance, with the result that, in a very few minutes, the entire colony is suffocated and combs melted down.

The question will naturally arise, "How are we to get the unscreened hive on the wagon without causing trouble to the driver or horses?" This is accomplished by smoking the entrance quite vigorously, putting the hive in a wheelbarrow, and trundling it across the beeyard to a point where the wagon is, without having the horses hitched to it. This smoking and jarring has a tendency to demoralize the colony to an extent that its predominant idea of self-defense is taken out of it.

Under Bee Hunting we explained how the continuous chopping on a hollow tree, or around where the bees are located, will remove all thought of self-defense, so that the log can be chopped off the main body of the tree without gloves or the use of a veil. In the same way smoking and jarring a colony about to be moved puts it in a condition where it can be handled without difficulty.

After all hives have been loaded, all the entrances should be smoked again, when it is claimed the team can be quickly hitched on to the wagon without any danger. The continuous jar of a wagon over the road puts the bees in a passive condition, and keeps them there until arrival at destination. If a colony is overstrong it will not suffocate, because the bees will crawl out of the entrance until relief is afforded.

If the combs are not wired, and the day is hot,* the hives should be loaded on a cushion of straw or on a wagon provided with springs. Either of these would obviate the danger of broken combs, and it is possible under those conditions the bees might recover enough of their colony spirit to show fight.

Perhaps some who object to this moving without screens will think of the cases where the screened-in colony will send out daughters-of-war whenever by accident the entrance screen is loosened or removed; but it must be remembered that if it is a shut-in colony, especially if it is suffering from want of ventilation, it will show fight, when the same colony not so shut in would be entirely mild.

As this plan of moving without screens has been tested by only a few expert beekeepers, we wish to advise the average beginniner not to try it. Indeed, even the veterans would do well to test it on a small scale at first. Much will depend on conditions—the man, the strain of bees, and the team, whether the plan will be feasible or not.

SHIPPING BEES LONG DISTANCES BY EXPRESS.

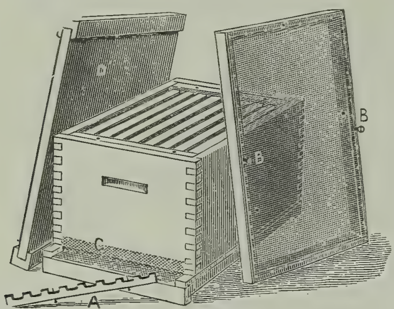
During hot weather great care should be exercised that the bees be not smothered, nor their combs melted down by the intense heat that is generated where they have an insufficient quantity of air during shipment.

We always tack a wire screen on to a frame about $1\frac{1}{2}$ inches deep, and of the same width and length as the hive. This is secured on top of the hive by means of two wood screws. Nails can be used when preferred, but screws are much more easily removed. The cover should be secured about two inches above the wire

* It is bad policy to move bees on hot days. Select a cool day, early morning or night for such work; but unscreened bees can be moved on hot days when those shut in can not.

cloth so it will act as a shade-board for the bees in case the hive should be put in the sun. The cover so placed may be the means of saving the lives of the bees.

To secure the frames so that they will not shove about, we use a notched stick, as

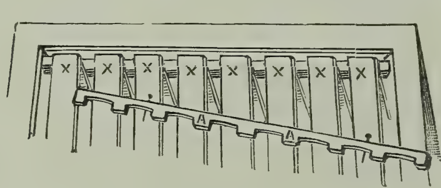


The Dovetailed hive, prepared for shipping bees.

shown at A A, of the accompanying cut, the pegs passing down between the frames just over the rabbet in the hive.

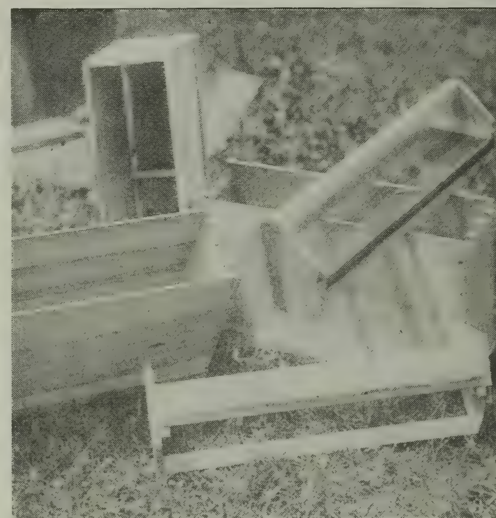
A couple of wire nails hold it secure. A similar notched stick is nailed to the bottom-board, notches upward, transversely through the center. This keeps the bottoms of the frames from jarring against each other. After the wire cloth has been secured to the entrance, the combs put in the hive and secured by the notched sticks, the wire screen screwed down, the whole arrangement is ready for shipment.

Of course, if the bees are on fixed frames—that is, either the Hoffman or the closed-end, referred to and described under Frames, Manipulating; Frames, Self-



spacing, notched spacing-strips are not so necessary, the frames being held apart for moving or shipping; but as a precaution we would use them so that the frames would not hop up and down when going over rough roads.

It is important that the combs themselves be wired, or at least that they be old, tough, and securely attached to the bottom-bar if not wired. It is always risky, however, to ship on combs not wired, because it is impossible to tell what sort of rough usage they will receive at the hands of careless or indifferent express agents;



Empty three-frame nucleus shipping boxes. Note that the boxes are made of light thin stuff, and screened top and bottom.

and while we should not be too hasty in condemning railroad officials for careless handling, we should take every precaution.

Three-frame nucleus shipping boxes filled with bees. The screen tops (with the convenient cross-rail for a handle) are secured to the nucleus box proper with two screws at each end. Such boxes are very handy for moving bees, either for shipping or carrying from one part of the yard to the other. They are also very handy for carrying combs.

The bees buzzing around the wire cloth is usually enough to guarantee safe handling.

Quite an extensive business is carried on in shipping bees in one, two, three, and four frame nuclei. The illustrations show a light shipping box, the sides and top of which are made of good strong lumber only 3-16 inch thick. The ends are 3/8. The bottom is covered with wire cloth, then two cleats are nailed across the ends to raise the nucleus off the floor. For the sake of convenience the wire cloth is secured on the special cover shown above, which, when set down in place, leaves a space of an inch between the cover proper and the wire cloth. The thin board over the wire cloth protects it from the direct rays of the sun, and from sharp projections of any object. It also affords a convenient place to attach the address, and to put on the caution, "With Great Care."

Bees go at a rate and a half by express, hence it is very necessary that the packages be as light as possible; and for that reason the combs should hold no more honey than just enough to carry them through to their destination. Neatly printed directions on the outside will explain stimulative feeding so that a nucleus may be made into a strong colony.

HOW TO SHIP BEES BY CARLOAD.

Within the last few years it has become more and more common to ship bees in car lots from one locality, after securing a crop of honey, to another locality where the honey-flow from another source, we will say, is about to begin. This enables the owner of the bees to gather two and possibly three crops of honey, when if he had remained in the same locality he would have secured only one crop. See Migratory Beekeeping.

The practice of shipping bees in car lots is being carried on to a considerable extent in the western States, where large producers find they can move anywhere from one to two hundred miles or more with a carload of bees to another State. The freight runs anywhere from 25 cents to $1.00 per colony. If the bees gather from one to two dollars' worth of honey per colony it will pay to ship them, for by so doing we very materially increase the earning capacity of our capital—the bees and their hives.

In 1912, after a very severe winter, when so many bees died in the North, and we knew there would be a great demand for bees, we sent a man to Florida for a carload of bees. The first shipment came through in such excellent order that we sent him back for a second lot. The first car load was seven days on the way, and the second one only five days. The bees in both cases came through in fine order, including sealed and unsealed brood. As a general rule bees will destroy all unsealed brood when shipped by freight or express, in small lots. This is because of a lack of water; but when sent in car lots a man can go along with the shipment and wet them down with a watering-pot every so often. This will save all unsealed brood, and prevent the bees from overcrowding the wire screens on hot days.

The first car load of bees we brought from the South came in time to strengthen up weak nuclei in the North. The second car, before starting, had secured a crop of tupelo honey. They were then shipped to Medina in ample time to catch a flow of clover honey that we had in 1912. The investment in both cases was a paying one. The honey crop secured in the North by the second lot of bees paid about all the expense of moving, including a man's time and part of the first cost of the bees. The bees sold out of both cars more than paid the balance, still leaving as many bees as we had in the first place as our profit. The first carload of bees arrived just in time to help out many weak nuclei in the North; so our own experience shows that migratory beekeeping, with the right man to manage, may be carried on successfully, as it enables their owner to double and in some cases treble the earning power of his capital—the bees and the hives.

HOW TO PREPARE A CARLOAD OF BEES FOR SHIPMENT.

In the first place, arrangements must be made in advance with the railroad companies over whose roads the bees are to travel, to see that there be no delays *en route*. Second, see that a good strong car—not an old rickety affair—is furnished. If the bees are to be moved in hot weather a cattle-car should be provided. In some cases it will be advisable to use a double-deck cattle-car, such as is used for shipping sheep and hogs. Such a car will save considerable expense in the way of lumber

and general crating if made to hold two or three tiers of hives. Arrangements must be made with some carpenter to make a series of shelves or platforms inside of the car at the point of starting. A freight car will take anywhere from 250 to 300 ten-frame hives. With the latter number it will require two tiers of hives arranged on suitable shelving or platforms. There must be a passageway 14 or 15 inches wide lengthwise down the car for convenience in loading and unloading and at the same time allow a man to reach any colony with a watering-pot to sprinkle down the bees when they cluster too closely on the wire cloth. The shelving should be made up of cheap 2 x 4 scantling and one-inch boards securely spiked together. Ordinary 2 x 4 scantling are used for the uprights and the horizontal rails forming the bottom of each set of shelves. One-inch boards, approximately eight or ten inches wide, and spaced about a foot apart, reach from horizontal rails supported by posts next to the central aisle to the horizontal wooden bars on the sides of the cattle-car opposite. They are then securely nailed in place. When the hives are loaded on the shelves, the boards or scantling should be laid on top and securely fastened to hold the hives down, for when freight cars bump together there is sometimes sufficient concussion to pile the hives one on top of the other unless the shelving is securely braced and the hives held down with suitable bracing.

Where the shipment is to be only one or two hundred miles it is not necessary to go to the expense of this special shelving work, especially if there are only about 200 hives. The hives are then laid on 2 x 4's properly braced on the car bottom. Another set of 2 x 4's is set on top of the lower tier of hives, and on these a second tier may be placed. These 2 x 4's should be securely braced, and the hives should be fastened to stand the end bumping of the car.

When bees are shipped in car lots, especially to go from the South to the North, it is important to have the hives screened at the top and *bottom,* as already described under Moving Bees a Short Distance with a Wagon. Frames should be securely fastened, whether self-spacing or the unspaced type. The attendant should take along a big stout hammer, spikes, and nails of various sizes, to repair breaks in the framework that may occur *en route*; also a saw, a small jimmy pry, a barrel of water with a cover, a watering-pot with which to water the bees, a bolt of cotton cloth, a cot bed, bedding, and last, but not least, an overcoat. He should make up his mind that he is not to take a Pullman-car ride. Indeed, he should be prepared to be up at all hours of the night or day. When the car stops, if the day is warm the wire screens should be wet down by the use of the watering-pot. In some cases it may be necessary to throw muslin over the outside of the car in such a way as to screen the bees from the sun. In lieu of the muslin a large piece of canvas may be used to advantage. In some cases it will be desirable to tack muslin over the top of the screens, especially if the bees are to go into colder climates, for the chilling blasts must be avoided. When it turns off hot again, the muslin should be removed from over the top of the hives and replaced when it becomes cold, or cold at night.

When the car stops it is advisable to procure two or three lunches ahead at some restaurant, for the attendant must pick up his meals as he can, *en route.* If he has to be up much nights to protect his bees he must sleep during the day; or he may have to be up nearly all night and day, and catch naps in between as best he can. He will be busy most of the time in giving the bees suitable protection from the hot sun or from the cold. At transfer points he must see to it that the *very next outgoing freight train* takes his car of perishable property. Experience shows that it is sometimes necessary to use a large amount of persuasion to get the conductor to take the bees, especially if he is very much behind on his schedule.

It goes without saying, that all combs to be moved in car lots should be wired. The hives should be loaded in such a way that the frames will be parallel with the rails —not crosswise. Every thing should be so arranged as to stand the heavy end shocks that come every now and then when the train stops or starts. End shocks are particularly heavy when the train bumps into a carload of bees. It is then that the attendant must be on the alert to repair any damage that may occur to shelving or hives.

Again, it is very important that colonies of bees that are to be shipped from one locality to another should be of medium strength. If one is very populous it will suffer much more than one moderately strong. Ordinarily we should say that about three pounds of bees and six or seven frames of brood would be about all that a ten-frame hive ought to have, especially for hot or warm weather. Colonies may be proportionately stronger in very cold weather, but practically all the loss of bees will be found to be within the hives that are too strong. Colonies of medium strength may have sealed and unsealed brood in two-thirds of the combs, provided the bees are wet down enough. Whoever undertakes to move bees in car lots should remember that confined bees require an immense amount of water. Too much must not be given at a time, but just enough to allay thirst and reduce the heat of the cluster against the wire cloth. When bees are distributed nicely down between the combs and none on the wire cloth, very little sprinkling will be needed if any. They always should be wet down when they cluster over the wire cloth, and roar.

SHIPPING BEES IN CAR LOTS WITHOUT COMBS.

Some discussion has taken place of late as to the feasibility of shipping bees in wire-cloth cages without combs, the cages having slats placed about an inch apart throughout the cage in place of combs. If the scheme could be made to work, as many as 1000 colonies could be put into a car and shipped from the North to the South, where now not more than 300 colonies can be accommodated.

There are certain seasons of the year when brood-rearing stops. If for any reason it continues, the queens can be caged until all brood hatches. Under either condition bees could be shaken off their combs into the wire-cloth cages referred to, and loaded into the car.

At the time this revision of this work goes to press, the experiment has not been tried, except in comparatively small express shipments (see Buying Bees); but we believe now that if it could be worked out it might effect a very great economy in shipping bees long distances. It would eliminate all danger of spreading disease; and if there was another set of combs at the other end of the route we should soon have full colonies ready for another honey-flow. If we could ship bees without combs in car lots, it would reduce the freight charge and cost of man to one third.

CAUTION.

Before closing, let us add a caution. In moving bees, be sure that you have fixed all the entrances so that not a bee can by any possibility escape. Do not have your wire cloth too short, and then splice it out with leaves. Be sure to have it cut exactly the right length. For further particulars, see Out-apiaries.

MUSTARD (*Brassica arvensis* L., Ktze.).—Wild mustard, or charlock, belongs to the same family (*Cruciferae*) as the turnip, cabbage, radish, and rape, all of which secrete nectar while in bloom. Introduced from Europe it has become naturalized over all the United States, and is often very abundant in grain-fields, where it sometimes presents an almost unbroken expanse of yellow. Almost equally common is the black mustard (*B. nigra* L., Koch), which flourishes everywhere in waste places. We have had a good opportunity of testing many of these plants, because acres of them are raised for other purposes than the honey. It will be a hard matter to determine which is best for your locality without trying every kind. Find out what market you have for your seed, and then proceed to raise it as if you depended on the seed alone to pay expenses. Should you secure a good crop of honey from it, you will then be so much ahead, and there is little chance of any great loss.

The seed should be sown very early in the spring, either in shallow drills so far apart that the cultivator can be used between them, or broadcast. The former plan is, of course, the better one for nearly all honey plants, but it is more trouble. From 6 to 10 lbs. per acre will be needed, sown in drills, and from 15 to 20 when sown broadcast. If you wish to save the seed, it should be sown not later than July 1.

Two kinds of mustard—the English yellow and the Trieste or red—are extensively cultivated in the Lompoc Valley, California. The latter comes from Aus-

tria, and gets its name from a town in that country where it is grown on a large scale. From this crop alone in a single year the farmers of this valley have realized a quarter of a million dollars. The average yield per acre is from 800 to 1000 pounds. The average price of the seed is three cents per pound, though as much as eight cents has been obtained.

The cultivation of mustard in the Lompoc Valley, says E. A. Oates, is easy and inexpensive; but it must be grown in rotation with other crops, and it will not produce bountifully two years in succession on the same land. When a majority of the pods are ripe it is ready for the reaper, and should be cut early in the morning or late in the afternoon, when there is moisture in the air to prevent the seed from shelling out of the pods.

The bees work alike on both yellow and red, which indicates that there is no difference in the amount of nectar they secrete. The period of flowering lasts about a month; and where the sowings are made at different intervals it can be prolonged for a period of ten weeks. The honey is mild in flavor and light in color, and commands the same price as sage. Though not as heavy-bodied as alfalfa, it has the same tendency to candy quicker. It may candy in the tank in four or five days, but this may be prevented by using a tank with a glass top, protected by a wooden shutter, which is removable at will, exposing the honey to the sunlight.

When sage is in bloom, bees appear to prefer its nectar to that of mustard. When it is not necessary, it has been observed by M. H. Mendleson that they will not gather from an inferior source. In 1884, he says, one colony out of 200 gathered exclusively from an abundance of mustard bloom; the 199 gathered from the sages. This was an exceptional case.

N

NECTAR.—Many times has honey been analyzed by competent chemists, but very seldom has there been an attempt to analyze nectar, owing to the difficulty of securing a sufficient quantity for experimental purposes.

The only satisfactory experiments of the kind which have yet appeared are those of Prof. Planta, of the university of Zurich, Switzerland, who was not only one of the best chemists in Europe, but also a competent beekeeper besides.

It will be noted he experimented with the nectar of two American plants, *Agave Americana* (century plant) and *Bignonia radicans* (trumpet-creeper). The former is a prodigious yielder of honey, far excelling any plant we know of in the North, and excelled only by some tropical trees such as *Protea mellifera, Hakeas,* and *Leucodendron,* and perhaps others not yet known. It grows in the southwest part of the United States, and is common in Mexico.

Several translations of Dr. Planta's article on nectar analysis have appeared, and we give one which we deem best for our purpose.

In the *Zeitschrift fuer Physiologische Chemie,* Band X., Heft 3, Dr. A. de Planta describes his researches on the chemical composition of some of the nectars in plants. He says it was a great pleasure for him during his researches on the life of bees to have established the relation which exists between nectar and honey, nectar serving for the preparation of honey. There was a great difficulty in getting a sufficient quantity of nectar, as plants yield it usually in small quantities, but there are some exceptions. Among these are *Protea mellifera, Hoya carnosa,* and *Tacoma radicans,* or trumpet-creeper, which contains such large quantities of nectar that it is easily collected. Thunberg says in his "Flora Carpensis" of *Protea mellifera* (*Zuykerbosches, Zuykerboom, Tulpboom*) that it flowers in autumn; that is to say, in March and the following months. The flowers are often half filled with watery honey which furnishes an excellent syrup after it has been filtered to rid it of insects and impurities, and slightly evaporated by gentle heat.

This syrup is an article of commerce at Cape Town. Two bottles of it were produced, the specific gravities being 1.375 and 1.372. It has a slight acid reaction, but contained no albuminoids or nitrogenous matter. It contained 73.17 per cent solids, 70.08 being glucose and 1.31 per cent cane sugar. By glucose is meant a mixture of crystallizable grape sugar (dextrose) and uncrystallizable grape sugar (levulose), both having a similar chemical composition. This glucose may already be formed in the nectar by the action of the ferments it contains upon the cane sugar, transforming it into glucose; and this inversion can be continued in new honeys, owing to the action (which he had already demonstrated in 1879) of the saliva of bees which also transforms cane sugar into glucose.

Grape sugar from the syrup was also obtained in a crystallized form. No trace of formic acid could be detected in the syrup, though quantities of pollen were found in suspension, determined by Professor C. Cramer to be that of *Protea mellifera,* testifying to its genuineness.

Wishing to compare this with fresh nectar, he succeeded, after great difficulty, in getting three bottles. The specific gravity was 1.078, 1.079, and 1.077. These contained 17.66 per cent of solids, of which 17.06 was grape sugar. They contained no cane sugar. There was not the least trace of formic acid. A comparison of the two shows that the difference was due only to the extra quantity of water contained in the fresh nectar.

Besides these he also examined the nectars of *Hoya carnosa* and *Bignonia radicans,* both in the fresh and evaporated states. The following table gives the results:

Nectar of		Sugar.	Cane sugar.	Grape sugar
Protea mellifera,	fresh,	17.06		17.06
" "	dry,	96.60		96.60
Hoya carnosa,	fresh,	40.64	35.65	4.99
" "	dry,	99.68	87.44	12.24
Bignonia radicans,	fr.,	15.27	.43	14.84
" "	dry,	99.85	2.85	97.00

Dr. de Planta has also made aqueous extracts of various flowers, among others those of *Rhododendron hirsutum* and *Onobrychis sativa.* In order to obtain 1 gram of sugar (equal to 1.3 grams of honey) the bees must visit at least 2129 flowers of *Rhododendron hirsutum* and 5530 of sainfoin (*Onobrychis sativa*).

As honey is almost entirely formed from nectar, he gives the following table, comparing the quantity of water he has found in nectars and also in old and new honeys:

	Water in		
Nectar of	Nectar.	Old honey	New honey
Protea mellifera,	82.34		
Hoya carnosa,	59.23		
Bignonia radicans,	84.70		
Fritillaria imperalis,	93.40		
Honey from			
Department of Landes		19.09	
Senegal		25.59	
Melipona,		18.84	
Canton Grisons (alt. 600 m.),		18.61	21.74
Sainfoin		19.44	
Canton Grisons (alt. 1395 m.),		17.52	20.41
" " (high Alps),			21.68
Buckwheat,			33.36
Acacia from Ingoldstadt,			20.29

Whereas the nectars vary between 59 and 93 per cent, the quantity of water contained in old honeys varies only between 17 and 21 per cent, and that in new honeys 20 to 21 per cent, with the sole exception of buckwheat honey, in which he found 33 per cent.

From these observations he thinks that the bees throw off a considerable quantity of the water while it is in their stomachs. He does not admit that it is evaporated entirely in the cells, for the analyses he has made of honey newly deposited in the cells show that it already reaches them considerably concentrated. The following table shows the relative proportions of sugar contained in different honeys:

A—Old honeys from—	Present.	Quantity formed by inversion.
Department of Landes	87.00	1.00
Senegal,	85.40	3.70
Canton Grisons (alt. 600 m.)	80.60	2.70
Sainfoin,	88.70	0.00
Canton Grisons (alt.1395 m.),	84.10	0.50
B—New honeys from—		
Canton Grison, Alpine region,	81.60	10.60
" " (alt. 600 m.),	81.60	9.30
" " Alpine region,	87.20	00.80

Although most of the nectars contain a considerable quantity of cane sugar it is found in very few of the honeys of the Alps. Some honeys contain a little, while in others it is entirely absent. It is clear that, during the formation of honey, the cane sugar in the nectar is converted into grape sugar by the saliva of the bees, which contains a ferment endowed with this property (see his researches on this subject in *Deutsche Bienenzeitung*, 1879, No. 12).

Another difference between honey and nectar consists in the former containing nitrogenous substances and formic acid. Mullenhof has shown how this last is deposited in the honey, and E. Erlenmayer has proved its antiseptic properties.—*British Bee Journal.*

Probably nectars do not all analyze alike; but Dr. Planta's analysis will be found sufficiently near an average to satisfy all practical requirements.

It will be observed Dr. Planta attributes the inversion of nectar to the saliva of the bees. It seems on the face of this to be only a "guess," and yet it has been repeated by many writers on the honey-bee ever since. We know inversion is taking place even while the nectar is still in the corolla of the flower, and it occurs long after the honey has been made and deposited, for new honey contains quite a large percentage of sucrose (sugar) whereas old honey contains little or none. We are very sure this change is caused by minute micro-organisms similar to those in soft sugar or rum. For this reason the composition of honey is quite variable—so much so as to baffle the best chemists to make a true standard by which to judge honey. Old honey therefore is actually superior to new, for the process of inversion is complete. If kept in a dry place it also contains less water, and, besides, loses the ethereal essential oils or essences of the flowers from which it was gathered; therefore nectar collected even from poisonous plants may become quite innocuous if allowed sufficient time to ripen. See Honey.

NUCLEUS.—This word, applied to bee culture, signifies a small colony of bees, perhaps from one-fourth to one-tenth of a full colony. The plural of the word is *nuclei*. It were well to bear this in mind, for there is much confusion in the use of the terms, even in printed circulars. If you remove a dozen bees from the hive, take them so far away that they are homeless, and then let them fly, they will after a time come pretty nearly back to the place from which you released them; but they will soon wander away and be lost, unless you give them a queen to which they will come back and probably remain if *she* does not stray away. She, like the rest, must fulfill her destiny, or disappear; we shall, therefore, have to provide her a comb wherein to lay eggs. The bees would build the comb themselves, provided they were numerous and had plenty of food. A dozen would never build any comb, nor make any attempt to rear and hatch her eggs if the comb were given them. Perhaps a hundred bees put in a suitably small box, with a fertile queen, might start a colony, and this is what we call a nucleus. It is the center, about which a colony of bees may in time be formed. Should they develop a full colony, the building-up would be done by the queen filling her combs with eggs, which, when cared for by the nursing bees (see Bees), would be converted into larvæ, and in 21 days hatch out perfect bees. These bees would then help the original hundred, and the queen would fill a still larger area with eggs, which would hatch in the same way, and so on. The difficulty in the way of building up from such small beginnings seems to be that the queen will lay all the eggs a hundred bees can care for, perhaps in an hour or two, and then she has to sit or loaf around for the whole 21 days, until she can have another "job." Before the 21 days are up, she will be very likely to get disgusted with such small proceedings, and swarm out, or at least induce the bees with her to do so. See Absconding Swarms. If we should increase the number of bees to 500 or 1000, we could get along then very much better, and there would be little danger of

swarming out unless the hive given them were too small. A very spry and ambitious queen might fill all the cells the bees had prepared for her, then set about filling them the second time, as they sometimes do, and then swarm out; but with a quart of bees—about 3200, if I have figured rightly — things will generally go along pretty well.

To have this quart of bees work to the best advantage, something depends upon the sort of hive they occupy. A single comb, long and narrow, so as to string the bees out in one thin cluster, is very bad economy. Two combs would do very much better, and three a great deal better still. It is like scattering firebrands widely apart. One alone will soon go out; two placed side by side will burn very well; and three will make quite a fire. It is on this account that we would have a nucleus of three, instead of one or two frames. Bees seem to seek naturally a space between two combs; and the queen seldom goes to the outside comb of a hive unless she is obliged to for want of room.

Sometimes difficulty will be experienced in making the bees of a nucleus stay in their new location. To overcome this, see Moving Bees.

FORMING NUCLEI FOR INCREASE; HOW TO DO IT.

Dividing colonies into nuclei for the sake of increasing the number of hive tenants is usually very bad practice, especially in the hands of beginners. See Dividing. When running for honey, colonies can not be too strong. Yet there are times, especially after a severe winter, when many colonies have died, that some form of artificial increase is desirable. Here is one of several plans we have practiced with success. We will start with one colony:

As soon as settled warm weather comes we would divide our colony into four two-frame nuclei, introducing an untested Italian queen to every division as formed; confine them at least three days (72 hours), tacking wire cloth over the entrance. At the end of this time remove the wire cloth, when the bees will stay contentedly without returning. If honey is not coming in we would feed a little every day.

When the queen fills the frame or frames with eggs, and there are bees enough to cover, we would put in another frame on the *outside*. As the weather warms up it might be advisable to put in still another frame, putting this one in the *center* of the cluster, in the mean time keeping up gentle feeding daily. A very good feeder for this purpose is the Boardman. See Feeders. This can be slipped into the entrance, and by screwing the can tightly or loosely into the cap the flow of feed can be regulated for the daily needs.

Make the syrup by mixing together sugar and water in equal proportion by measure. Stir thoroughly, and pour into feeder-cans.

As soon as the nuclei have four or five frames of sealed brood, larvæ, and eggs, take out one or more frames from each, and form another. This plan can be continued till one has 15 and possibly 20 little colonies; but he should stop dividing at least 60 days before the setting-in of cold frosty nights.

If one can not afford to buy queens he will have to raise them and then the increase will be cut down more than a half, probably.

In 1892 the writer, without any special effort, reared all the queens, and increased an apiary from 10 colonies, some of which were almost nuclei, to about 85 good colonies that went into winter quarters. They had no empty combs, but they were given full sheets of foundation. They were not fed, but made to depend entirely on natural sources for their supply. Had he fed after the honey season, and given empty combs, he might have made double the increase.

CAUTION.

It is very important during a dearth of honey that the entrance of the nucleus be closed for twenty-four hours or more with wire cloth or with grass, as described under the Somerford method, further on. Robbers are quite sure to attack a nucleus newly formed if the entrance is not closed. Right after the division the little bunch of bees is confused, and before they have regained the colony spirit they will not defend their entrance. After they have been confined for a time they will stay

in their new home better, and be prepared to meet any robber that may be inclined to pry into their hives.

CONFINING TO KEEP THE BEES IN.

Another method, first introduced to the beekeeping world by Mr. W. W. Somerford, is reported to give such good results that we are glad to place the plan before the readers of this work.

To begin with, remove the queens or cage them in all your fancy stock, after getting the brood-nest well filled with brood (the more brood the better—8 or 10 frames in a hive if possible). Wait ten days after removing the queen, when the bees will generally have cells on each and every comb, and be in a broody or listless condition, waiting for cells to hatch. Divide and remove the frames quietly, giving each new hive two frames of brood and all adhering bees, and one good frame of honey, using it for a division-board (and, by the way, such division-boards are to my notion the best in the world); put the two frames of brood and bees next to the wall of the hive, and let the honey-frame be the third from the side of hive. Be sure to see that you have at least one good ripe-looking cell in each new hive, or division, and don't forget the frame of honey. As soon as each division is made, stop the entrance of the hive by stuffing it full of green moss. If you haven't any green moss, use green grass or leaves, and be sure to stuff them in tight—as tight as though you never intended the bees should gnaw out, and be sure there are no cracks or holes that a single bee could get out at; for if there are, your division will be ruined by all, or nearly all, the bees that can fly leaving it. Each parent colony should make four or five good divisions that will make booming colonies in 40 or 50 days, and I have had them the best in the apiary in less time. Leave or loose the old queen on the old stand (if not too old), and the bees from it will work straight ahead, as they don't have to be confined to make them stay at home.

Don't be uneasy about the divisions that are stopped up, unless you failed to stuff the entrances well, for they *will not* smother, but busy themselves gnawing at the moss or grass for two or three days, possibly four or five, if you have done an extra good job at stuffing the entrance. At the end of that time you will find they have all gnawed out so as to secure egress and ingress. Then you can move enough of the grass or moss to give them a clean entrance, 1½ or 2 inches wide; and by looking into them you will be astonished at the quantity of bees you have in each hive (and they, too, well satisfied), having consumed so much time in gnawing out that the queen had time to hatch and kill off her rivals and be ready for the wedding-trip by the time the entrance is cleared. So, instead of, in a week's time, having a worthless weak division with a *chilled* inferior queen, as is the case in the old-style way of dividing, where nine-tenths of the bees return to the old hive, you have a strong vigorous queen and a nice little *satisfied* swarm of bees, ready for business in the way of pulling foundation before they are three weeks old.

I have succeeded with nineteen out of twenty divisions made in the above way, when I did not even see them until the third week, after dividing as above; and for the average beekeeper who has out-apiaries I think there is no better way in the world to make increase. If there is I'd like to see or hear of it while the expansion question is being aired.

In the above method of increasing, you have no queens to buy, no robbers to bother with, and but little time lost, as an expert can make 20 divisions an hour.

Navasota, Tex.

In the first paragraph, Mr. Somerford mentions removing or caging the queen. We should, perhaps, explain that usually any queen can be caged in her own hive for weeks at a time, and her bees will take care of her through the wire cloth. If a queen is removed entirely it is implied that she is to be caged in another hive, or introduced. She may, however, be put in a cage supplied with queen-cage candy, and kept for a week or ten days in a warm room. But there would be danger of losing her, as she might die, because, under artificial conditions, she can not get the "balanced rations" that she needs to keep up her bodily functions.

Another plan of making two colonies out of one is given under the head of INCREASE, which see. For full consideration of the subject of BABY NUCLEI, see QUEEN-REARING.

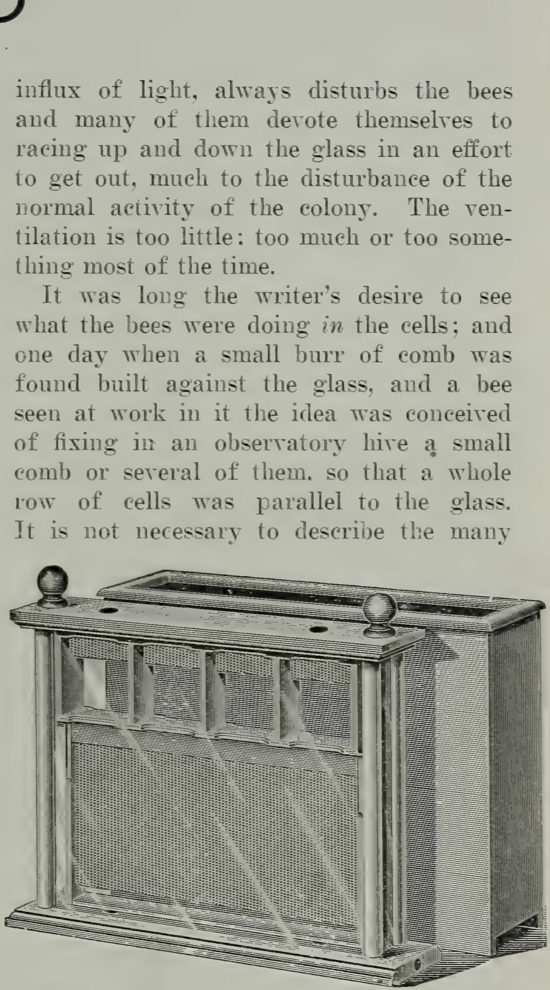
A portion of Mr. Stewart's apiary, Contra Costa County, California.

O

OBSERVATORY HIVES.—The origin of hives with windows or transparent sides is lost in the mists of antiquity. In very ancient times pieces of transparent substances such as horn, isinglass, mica, etc., were let into the sides of the hives that the work of the bees might be observed. Such windows, however, afforded but meager opportunity for studying the behavior of the bees in the hive. The first approach to the modern type of observatory hive was invented by Mr. W. Mew, of Easlington, Gloucestershire, England, about 1650. This appears to have been but little more than a hive with glass windows. At about the same time, Mr. John Thorley, of Oxon, England, put bees in a bell glass and used bell glasses as surplus chambers on his hives. No practical advance was made from this until about 1730, when Reaumur the eminent French naturalist established a swarm between two panes of glass. These panes were so far apart that the bees could build two combs between them, hence much of the work of the bees and queen was hidden. Bonnet the Swiss naturalist recommended a hive with "doors" only so far apart as to permit the bees to build one comb between them; and Huber, about 1790, adopted this suggestion, and the result was the wonderful advance which he and his faithful assistants, his wife and his servant Burnens, made in the knowledge of bee life. From that time until the present, little change has been made in observatory hives, except in so far as the use of movable-comb hives changed the methods of stocking them.

Three factors are to be found in all of these hives: a comb, the surfaces of which only are visible, the use of shutters to darken the hive interior when not under observation, and sundry ventilating holes. The bees, when entering the cells of the comb, effectively shut off all view of what they are doing within them. The removal of the shutters and the consequent sudden influx of light, always disturbs the bees and many of them devote themselves to racing up and down the glass in an effort to get out, much to the disturbance of the normal activity of the colony. The ventilation is too little: too much or too something most of the time.

It was long the writer's desire to see what the bees were doing *in* the cells; and one day when a small burr of comb was found built against the glass, and a bee seen at work in it the idea was conceived of fixing in an observatory hive a small comb or several of them, so that a whole row of cells was parallel to the glass. It is not necessary to describe the many

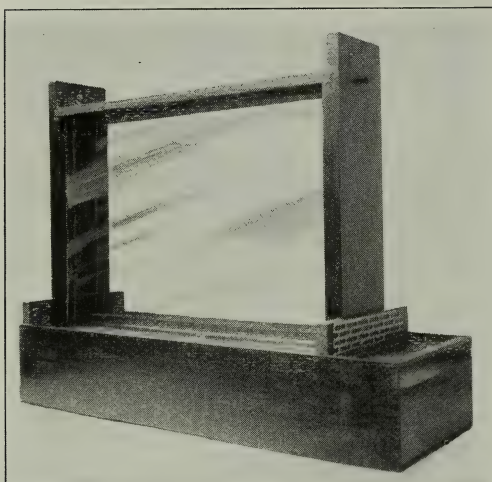


Ordinary observatory hive for showing a single comb and a set of sections as they appear in a regular hive. This form of glass hive is usually shown at fairs and expositions to illustrate the relation of combs to sections.

and crude attempts before success was achieved, but at last a stage was reached where a row of combs was fixed between two panes of glass about four inches apart, and a small colony established therein.

The hive was placed indoors before a window, the bees passing in and out beneath the partly raised sash. The little colony started at work nicely, and soon honey and pollen were being stored in the cells against the glass. By accident the wooden shutters were left off the hive for two or three days, and when it was

observed at the end of that time the bees were found at work in a perfectly normal manner and no running over the glass was noticeable. Obviously, the shutters were not necessary, and their abandonment seemed to mark a distinct advance. A cold storm which occurred shortly after nearly destroyed the colony, and the shutters



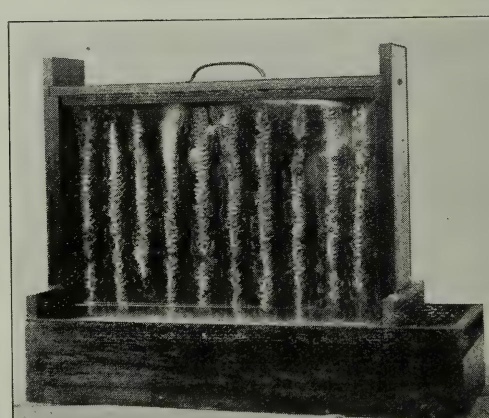
Miller's observatory hive.

were again used. Matters improved, and the colony gained until another storm put them back again despite the shutters. Investigation showed a sharp draft *through* the hive from the entrance to the sundry ventilators. These were closed, but the entrance did not furnish sufficient air, and other troubles appeared. Then followed long experimenting with ventilation until at last a relatively large area at the *bottom of the sides* of the hive was opened for ventilation and screened to confine the bees. This was all below the combs and the bees could have as much or as little air up among them as their instincts dictated. That was a success, but it developed another trouble, for every time the door of the room was opened or closed, or if the wind was strong toward the window, the bees were blown out of or into the entrance in a most troublesome way. A short passage or tunnel considerably larger than the hive entrance and having a wire cloth top was applied between the entrance and the window opening, and that trouble stopped.

This was not all done in one hive or in one season, but extended over several years. The colony would seem thrifty for a time, then it would meet with some reverse and it would often take a season or two to find the cause of the trouble.

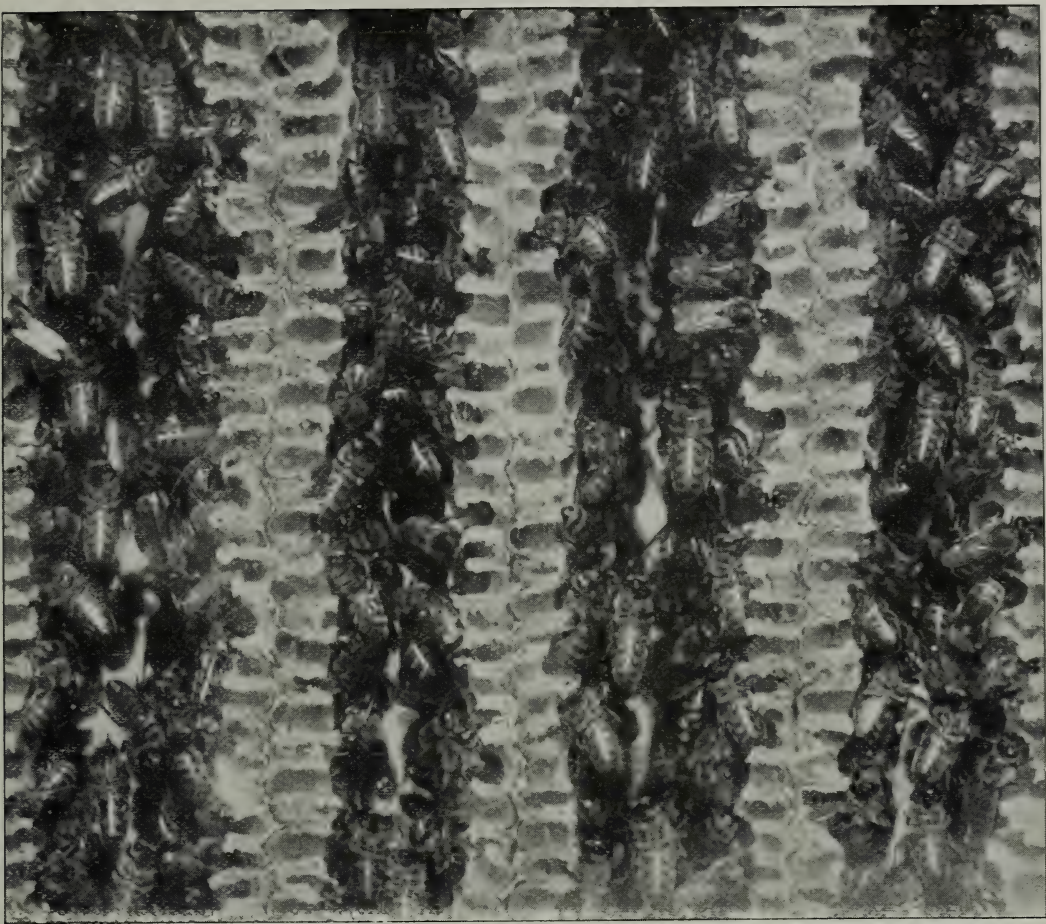
There came a day when eggs were seen in cells next to the glass, and in due time they hatched and the larvæ were fed and grew until they touched the glass, then the bees pulled them out. The shutters were tried but with not much advance. Then "storm sash" in the form of an extra pane of glass on each side were applied and the hive was a success. A quarter of an inch confined air space was left between the panes.

From then on, the bees used the cells next to the glass as readily as the others. *Almost* every action was observable; the bees could be seen every way except face to face. Another hive was made and stocked and a piece of comb was put in which was less than half a comb, for it was only the cell walls from one surface of the comb. The glass wall of the hive was to and did form its new base. The bees used it as readily as the other combs, and the queen laid in it and bees were raised in it. The book of nature had been opened at a new page. Thereafter the



Miller observatory hive.

development of the hive was a matter of detail. As now made it has a base about six inches wide and deep enough for a grooved feeder block to be slid into it under the floor of the hive. Access to this feeder is obtained through several holes bored in the floor and guarded with excluder metal to keep the queen from wandering in. A similar guard is adjustable at the hive entrance to prevent the loss of



A close view of comb built against the glass of the Miller observatory hive. This form of hive enables the observer to see the bees at work in the cells, the hatching of the egg, the development of the larvæ, and the growth of the bees.

a swarm if the little colony has to be left to itself for an extended period, for if thrifty it soon becomes overcrowded. The uprights are approximately three inches wide and grooved for four panes of glass, the inner panes being about one inch apart and the outer ones a quarter of an inch from the others. Panes fifteen inches long by ten inches wide have been found to be a very satisfactory size. The uprights are fastened to two horizontal pieces extending across the base. These latter pieces each have a groove one-half inch above the floor. Into these grooves are slid two strips of glass to close the space at the bottom between each pair of panes. Between these strips and the raised sides of the base, strips of wire cloth are put and furnish the ventilating area. Galvanized wire cloth of fine mesh has proved preferable to ordinary painted wire cloth. The woodwork of the hive and the wire cloth is painted a dead black, both inside and out. This gives a sharp contrast with the combs, and is advantageous when taking photographs. The outside of the hive may be finished in natural wood, but the inside of uprights and under side of top should be dull black.

The distance between the inner panes has been varied from half an inch to three inches. The former is too close and the latter unnecessarily wide. An inch to an inch and a quarter has been found most satisfactory, and then no bee can completely escape observation.

To stock this type of observatory hive is a bit troublesome. The two panes of one side of the hive are removed and the hive is laid on its side in a box prepared for the purpose, the "tunnel" of the hive connecting with an entrance in the side

of the box. If this box arrangement is not used, trouble will be experienced by bees clustering on the outside of the ventilators. A sheet of new comb has previously been given to a colony; and as soon as it has larvæ one to three days old it is ready to use. It is cut *vertically* into strips just a little narrower than the space between the inner panes. These strips are then laid in the hive, spacing them about an inch and a half from center to center. It is desirable that comb containing some honey be used also, and if there is not any honey in the uppr part of the brood comb, a strip or two of comb containing honey should be cut from some other sheet. If cells with the *ends* against the glass are also desired, a little more delicate work is necessary.

From a new dry comb a strip somewhat wider than needed is cut, then with a *hot* knife the cells are cut from the base. These baseless cells are very delicate and must be cut to the required dimensions with the hot knife. They are then lifted on a cool knife or piece of card-board and slid into position in the hive. No gluing or waxing is needed, for the bees will do that perfectly.

The other pair of panes are next carefully slid into place. If any of the strips were cut too wide the glass will hit and move them and cause a lot of trouble, but otherwise the operation is easy. The entrance guard is lifted, a queen put in and the guard replaced, and the cover put on the box. On a wide board in front of the entrance are now shaken the bees from two combs taken from any hive. The older bees will go home, the others will crawl into the hive. They go in better if the hive is dark; hence the putting of the cover on the box; but it may be opened from time to time to watch matters. If they are a little slow to enter they may be hurried by a gentle puff of smoke now and then, but on the whole it is better to let them take their time.

This operation is preferably done near the close of the day, and at a time when nectar is being secured, then robbing is not troublesome.

The hive is left in its horizontal position for a couple of days, the box being shaded from the direct rays of the sun. If it is found that not enough bees are in the hive to fill the spaces fairly between the strips of comb, more may be shaken in front at any time. In about two days all of the combs will be seen to be attached to the upper one of the inner panes. The other side certainly is. The hive may now be taken from the box, set in an upright position and taken away.

MAINTENANCE AND OPERATION.

As soon as the hive is in its place syrup should be given in the feeder and feeding continued for several days, for the little colony has virtually no field force, and will soon exhaust the honey in the combs. Also the feeding will stimulate wax production and enable the bees to complete the combs. During a heavy honey flow these little colonies will gain stores, but in a light flow their field force is too small and help may be needed in the shape of syrup or honey in the feeder.

By coloring syrup (using a candy color) it is easy to see just where it is put first and more or less of it moved afterward. An ounce of deeply colored syrup is enough to use at a time for this experiment.

If feeding is necessary in cold weather, use a *hot* syrup, nearly filling the feeder (a half pint). It will warm the hive and arouse the bees, and as soon as the syrup cools sufficiently they will take it. Use for this purpose a syrup made of two parts sugar and one of water. If the weather is very cold, close the hive and remove it to a warm room, keeping it there until the bees have taken up all or most of the syrup. If, however, the combs were packed with stores before settled cold weather, and the room temperature keeps between 35 degrees and 60 degrees F. as the extremes the bees will not need feeding until spring.

If the hive becomes over-populous remove it at night to some other window and in its place put any convenient box containing a piece of comb with unsealed brood, or a caged queen. The next morning the field force will start out as usual, but will return to the old location where the brood or queen will hold them. As soon as the population of the observatory hive seems to be reduced enough, close its entrance to prevent the escape of more bees. Within two or three hours the box on the old location may be closed and taken

away and the hive put back and the entrance opened. The removed bees may be destroyed or kept confined for a few days, and then at nightfall be dumped into some hive in the yard.

If the colony in the observatory hive becomes weak, it is most easily strengthened by turning in a lot of young bees. An easy way to do this is to shake into a box the bees from a comb from some thrifty colony in the apiary, and cover the box with a piece of wire cloth. Carry it to the observatory hive and fix it so the edge of the box is close to the opening to the tunnel. Remove the wire cloth over the box and the bees will soon enter the hive.

The same manner of weakening and strengthening may be followed with the prevailing types of observatory hives, but it is often easier with them to remove the comb and bees and restock the hives completely.

The new type of observatory hive is good for about two years without renewing the comb, but after that the comb becomes dark and opaque and the glass more or less coated with wax lumps, propolis, cocoons, etc., so that it has proved more satisfactory to restock the hive every year.

Bees winter nicely in these little hives provided the temperature of the room does not go to freezing or stay below 40 degrees F. very long at a time. A room temperature up to 65 degrees or even 70 degrees does not cause trouble in the winter, provided the hive entrance is wide open. A few bees may venture to go out; but by the time they reach the outer end of the tunnel they meet the cold air and turn back. A window facing south is the best for winter; but any exposure will do for summer, though one not facing the prevailing winds is to be preferred.

All types of observatory hives should have the ventilating space solely at the bottom of sides or ends, and with double glasses with a confined air space between them. Extra space into which the bees may spread and yet not build comb is greatly to be desired, particularly in single-comb hives. This and ideal ventilating conditions are secured by having the floor wider than the hive and having such extension covered by wire cloth spaced half an inch above it.

ORANGE (*Citrus aurantium,* round orange; *Citrus decumana,* pomelo, or grapefruit; *Citrus limetta,* lime; *Citrus mobilis,* "kid-glove" oranges, mandarin, tangerine; *Citrus limonum,* lemon).—All the members of this family, the *Rutaceae,* commonly called "citrus stock," are included under the general name of "oranges" so far as honey production is concerned. It would be no misnomer, therefore, to call, as we do, all honeys from any and all of these species "orange-blossom honey." While in certain seasons, and under special artificial care, in cold winters, the trees will do well as far north as Jacksonville, Fla., still it remains true that the home of the citrus is in the southern half of the peninsula. The blossom period varies. It is very erratic, owing to rainfall, soil, variety of fruit, degree and extent of cool weather in the winter and early spring, etc. For instance, in the middle of the State blossoms have been seen on the round orange as early as Feb. 6; and in 1912 the first bloom appeared on normal trees March 15. As a rule, for that locality Feb. 20 will be about an average time for the appearance of the minute balls that are to be the snowy-white blossoms. The bloom period lasts about four weeks if the weather is not too hot and dry. The later the bloom appears, as a rule, the shorter the period of its blooming. A cool or frosty period during the bloom will prolong it, unless the frost is so severe as to damage the blossoms; then it shortens the bloom as it did, for instance, in 1911. No more beautiful sight can be imagined than an orange-grove in full bloom. The air is redolent for a quarter of a mile around in all directions with the perfume, and the white blossoms among the green leaves are a sight not soon forgotten. The bloom is as sensitive to weather conditions as that of the mangrove. Too hot, too dry, too wet, too cool, all these make the secretion very fickle. As a result, orange is not to be counted on for nectar in paying quantities oftener than one year in three, on an average. A warm damp day, with sun and cloud alternating, seems best for nectar secretion. Then the nectar can be seen in early morning shining in the white petals, ready for the visits of the bees; and they lose no time in getting at it, either! Then the bees come tumbling down on the edge of the alighting-boards, too

Orange blossoms.

tired to do more than crawl heavily into the hives, and that often after a brief rest if the day is windy. Those blossoms deep within the shade of the trees linger on latest, and then, suddenly, without a sign of warning, the nectar will cease as suddenly as it began. The honey is light amber, clear, and crystalline, with none of that thick opaque tint sometimes visible in even clear amber palmetto honey. The body is not so heavy by any means as that from the scrub palmetto, though it is heavier than that from the cabbage palmetto. But the flavor is the thing! It has a delightful "fruity" aroma, when pure, that can not be duplicated by any other honey. The bouquet of the blossoms seems preserved in the honey. Mr. Ernest R. Root once said of a sample of pure orange-blossom honey sent him by Mr. Edwin G. Baldwin, of DeLand, Fla.: "We are inclined to think the flavor is a little finer than any thing of the kind we have ever tasted." But it is not easy to get "pure orange honey." It is not because of the beekeeper, but because of the limited area where the trees are dense enough to make a single item in the honey line. There must be thousands of trees within an area of six miles diameter, and little else in bloom at the time. Mr. W. S. Hart, of Hawks Park, Fla., sums up the matter thus: "Pure orange honey is unexcelled in color, body, and flavor. But it is, and always will be, scarce." But in California there seems to be, notwithstanding, a large amount of orange honey produced. Wild cherry, andromeda, and other sources often give a dark tint and dark-brown taste to the sweet orange honey. A very little admixture of either of these two will spoil the pure article. There are many thousands of orange-groves, from the north to the Keys, from the east coast to the western shores; but they are not always grouped about a common center closely enough to make profitable foraging for bees. For this reason there are not many good orange-blossom localities. Probably Volusia Co. has more sections where pure orange honey can be obtained than any other single county in Florida, unless possibly it be Manatee Co., on the west coast. Wauchula, in De Soto Co., and Orlando, in Orange Co., are also inviting sections for orange honey. Near Eustis, Fla., are extensive groves that seem attractive and promising. Palmetto, Fla., is in a good location, and there are one or two beemen there who are improving it. Mr. E. B. Rood, of Bradentown, is one apiarist who secures a good lot of fine orange honey if the season is at all favorable. E. G. Bald-

win, of DeLand, is saving all that precious nectar that a hundred colonies or more can extract from the snowy petals every year. It is hard to state an average yield per colony of this honey. It might be better to say that, in a *good* year, an average of 40 lbs. would be satisfactory, and in poor years—well, any thing would be better than none! It is certain, however, that, as scientific beekeeping becomes more and more widespread in Florida, and the good locations discovered and exploited, orange honey will become better known than it is now. The white fly is damaging the groves to a certain degree, and that always shortens the bloom; but the spraying with red fungus is slowly but surely making itself felt, and no doubt that enemy to the fruit man, and hence to the beeman, will disappear altogether in time.

ORGANIZATIONS OF BEEKEEPERS.—The reader of this work ought to ally himself with some local organization of beekeepers if there is one, and with the National Beekeepers' Association. This society has already a membership of over 2000, and is composed of the most successful beekeepers in the United States and Canada. Its object is to protect the beekeepers in their rights, to secure pure-food laws, to disseminate useful information, to fight adulteration—in short, to look after the interests of beekeepers as a whole. It has secured many valuable precedents in law, and has shown that bees are not a nuisance *per se;* that they can be kept in incorporated villages and towns, and that they are like any other property.

The annual membership fee in the Association is $1.50. This secures to the member all the rights and privileges of the society, the right to vote at its annual meetings and at the annual election of officers; the annual report of the work done, and a stenographic report of the three-day conventions that are held in all the principal cities of the country. This report contains verbatim discussions by the most successful beekeepers in the United States. A report alone is well worth the membership fee.

The Association consists of a President, Vice-president, Secretary, General Manager, and a Board of five Directors.

One who has very many bees can not afford to do without one or more bee-journals, neither can he afford not to be a member of the National Association. He may never know when he may be sued for damage on an alleged trespass by his bees, or notified to move them out of the town or city. The small membership fee of $1.50 entitles him, under certain conditions, to the protection of the General Manager, who, when circumstances warrant, will employ an attorney and fight the case to a finish. One can not secure protection by joining the Association *after* he gets into trouble.

The Secretary's address can be ascertained in any of the bee-journals.

OUT-APIARIES.—Within late years this term has been used to apply to bee-yards remote or distant from the home yard by some two or three miles. It is a well-known fact, that only a limited number of colonies, comparatively, can be accommodated in any one locality, different places being able to support widely different numbers of colonies.

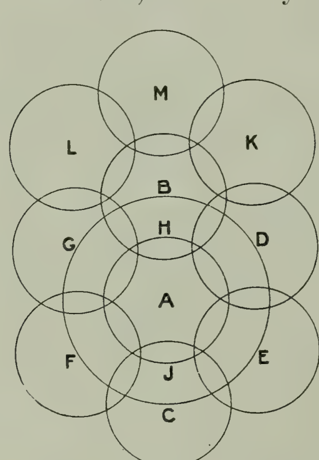
NUMBER OF COLONIES IN AN APIARY.

The number of colonies of bees that can be profitably kept in one locality is limited by the amount of pasturage. Of late years quite a number of beekeepers have established one or more out-apiaries, for the sake of keeping more bees than the home pasturage would support. Just how many bees can be supported in a single locality has probably never been ascertained, and it is just as probable that it never will. One field may support five times as many as another, and the same field may support five times as many this year as last. Most beekeepers, however, think it inadvisable to keep more than 75 to 100 colonies in one apiary, while a few think their locations so good that 200 or more can be profitably kept together. The man who has only a few more colonies than he thinks best to keep in one apiary may find it better to have his bees *just a little* crowded at home before he goes to the extra expense of an out-apiary. Indeed, it depends somewhat upon the man, whether, having been successful with one apiary, he will find any profit in the second. But having gone so far as to have one or more apiaries away from home, it is not best for him to have

any crowding in the least. If 100 colonies will do well in each apiary, the probability is that 75 will do better; and while there is unoccupied territory all about him he had better keep on the safe side and have so few in each place as to feel sure of not overstocking. His own convenience should have much to do in deciding. For instance, if he has, in all, 300 colonies, and thinks that 100 can find enough to do in a place, but can get through the work of only 75 in a day, then he will keep the 300 in 4 apiaries of 75 each, rather than in 3 apiaries of 100 each. For it will make one less travel to have in each apiary just what he will do in a day's work. If he can do 50 in a day, then he may just as well have 100 in two apiaries as in one, for in either case he must make two trips to get through with them.

DISTANCE BETWEEN APIARIES, AND LOCATION THEREOF.

A location for an out-apiary must, of course, be far enough distant from the home apiary not to interfere much; but just how far is best, it is not easy to decide.



Perhaps, all things considered, a good distance is something like three miles apart. As the area of flight is a circle, the ideal plan of locating out-apiaries so as to occupy fully all adjoining territory is to put them in hexagonal form, in which case a circle of six will surround the home apiary.

In the diagram, A represents the home apiary, and B, C, D, E, F, G, the out-apiaries, at equal distances from A and from each other. If more than seven are needed then a second series may be started, as at K, M, L, indicated by the letters. The circles representing the area of flight from each apiary are seen to overlap each other; but this is at the outer parts, where the ground is more sparsely occupied, and the doubling on the same ground is compensated by the convenience of the shorter distance to go from one apiary to another. But this ideal plan, although a good thing to work from as a basis, is not likely ever to be fully carried out. Many reasons will make it desirable to vary. The roads may run in such directions as to make a difference; no good place may be found for any apiary at some of the points, etc. It may be remarked that the area of flight is not always a circle. An apiary placed in a valley between two ranges of hills might have an oblong area, the bees perhaps flying twice as far along the line of the valley as in the other direction. If only a single out-apiary is to be planted, it is probably best to go in the direction of the best pasturage—a thing not always easy to determine. Sometimes one location proves to be better than another, year after year, although no apparent reason for it can be seen. It may even be worth while to vary a location a mile or more for the sake of having it where pleasant people live. But you can do much toward making the people pleasant by being pleasant yourself. See to it that you make as little trouble as possible, and be still more careful than at home to avoid every thing that may incite robbing, for robbing begets cross bees on the place.

RENT FOR OUT-APIARIES.

The agreement between the beekeeper and his landlord, for rent, is as varied as the cases that occur. Some pay a fixed sum, five or ten dollars per year; others agree to pay a per cent of the crop; some make a bargain to pay so much for every swarm hived by some one of the landlord's family, and so on, while some can not get the landlord to agree to take any rent whatever. In this latter case it is only right to make sure that the landlord has a good supply of honey for his family to use during the coming year. In any case, be sure to do a *little better* than is expected of you.

HAULING BEES AND SUPPLIES.

Whenever you decide to start a second apiary, you must give some attention to

the matter of hauling. If you winter on summer stands, there will be less hauling than if you bring all your bees home to winter in the cellar and then take them back again in the spring. If you use chaff hives you can have light cases made to carry merely the brood-frames with the bees. The first thing to see to is to make *very sure* that no bees can get out to sting the horse or horses. Of course, you think you are careful, and that there is no need of anxiety in your case; but, wait and see. The probabilities are that, with all your care, one of your first experiences in hauling bees will be to get your horse stung; and you may be thankful if you get off without a runaway and a general smash-up. Some little leak evaded your notice, from which the bees escaped, or you drove your horse too close to the apiary, or in some other way you may find yourself in such a scrape that you may wish you never had any thing to do with bees. A. E. Manum used on his horses a sheet of cotton cloth which completely covered head and body, and kept it on until some half a mile distant from the apiary.

You can haul bees on almost any kind of vehicle. Some use wagons with springs; some use a hay-rack with two or three feet of hay on it, while others use a common lumber-wagon, or a hay-rack with neither hay nor springs, leaving the frames with no other fastening than the propolis and brace-combs. With smooth roads this latter plan is very satisfactory. With good level roads it may be best to have the brood-combs run across the wagon, as most of the shaking comes from the wagon rocking from side to side, while a road very rough may make it best to have the combs running parallel to the line of travel. Where combs are secure, it will matter little how they are placed. To carry colonies of bees to advantage, some sort of rack is necessary. As we are not farmers we had to extemporize a rack for our one-horse wagon.

Automobile truck wagons are getting to be so common and cheap that it will be a question of only a short time before they will supplant the horse-drawn wagons for hauling bees. An automobile truck will, of course, be bee-sting proof against any accident that may happen to a horse-drawn vehicle; and, moreovor, it will make the trip from one yard to another in a half or even a third of the time.

Whatever the kind of hive is used, some plan must be adopted for fastening in the bees, so that they may have abundance of ventilation while being hauled. As, however, the hauling is done in spring and fall, less ventilation is needed than during hot weather. The ordinary entrance, say 14 inches by 3/8, covered by wire cloth, will answer, as that gives a ventilating surface of about 5 inches, although more would be much better. See Moving Bees. Of course, the bees should all be shut in when not flying, and in spring it is a good plan to shut up in the evening all that are to be hauled the next day. In the fall the weather may be such that bees will not fly at any time in the day, otherwise you must get to the out-apiary early enough in the morning to shut in all the bees you will haul that day. If you are to take bees to an out-apiary in the spring, the sooner it is done the better, as pasturage is then apt to be rather scarce at best. Where bees are to be brought home in the fall to be cellared, they may as well be brought just as soon as heavy frost occurs, or as soon as they stop gathering; at least, they should be brought early enough to have a good fly before going into winter quarters. After being unloaded from the wagon the bees may be liberated at once by blowing in a little smoke or dashing in some cold water; or, if loaded too late in the evening to fly, they may be left till the next morning when they will be quietly settled down; and if carefully opened, no smoke need be used. For full particulars on the difficulties in hauling bees see Moving Bees.

TOOLS FOR OUT-APIARIES, AND WHERE TO KEEP THEM.

Whatever tools you use in the home apiary, you are likely to need the same in each out-apiary. If a different person is in charge of each apiary, then each one must have his own set of tools; and even if the same force go in succession from one apiary to another, it may be the more convenient to have a separate outfit kept at each place. We do not think just now of any thing in the line of tools needed for an out-apiary, different from those that are needed at home, unless it is a robber-

cloth. We should not like to be without one of these in the home apiary, but they are specially valuable in out-apiaries where, sometimes, notwithstanding robbers are troublesome, your plans are such that you want to force through a certain amount of work. By having two or three robber-cloths we have sometimes been able to go on with our work when, without them, we should have been obliged to desist. We'll tell you how to make one. Take about a square yard of stout sheeting or cotton cloth; if your hives are small, less will do. Lay one of the cut edges on a piece of lath, about the length of your hive. Lay a similar piece of lath on top of it, and drive wire nails through both, at a distance of perhaps three inches apart. Let the nails be long enough to reach through and clinch. Then treat the opposite edge the same way, and your robber-cloth is complete.

This robber-cloth is exceedingly convenient to throw quickly over any hive or super that you want to cover up temporarily. You can grasp a lath at the side with one hand, and, with a single fling, throw it over a hive making it instantly bee-tight. It does not kill bees, if any happen to get under it. If you have one hand occupied with something else, you can very quickly uncover and cover with the other. We have sometimes worked with a colony when robbers were so bad they would pounce into every opening; but a robber-cloth on each side covering the frames allowed us to make an opening at the frame we wished to take out. As a general rule, of course, we would try to manage not to work the bees at such times.

But, to return. It would be very convenient, as you go about from one apiary to another, to have a little tool-house at each yard. We are not sure, however, that it would pay. A hive or box covered over water-tight (we use a tin hive-cover) answers very well. We would have one or more of these at each apiary in any case, for there are some things you want to be sure of having on hand, as smoker fuel. Matches should also be kept under cover in such a place, in a tin box. A baking-powder box does well. Bee-hats, smokers—in fact, a full set of every thing can be kept in the same way.

It is possible, however, to get on very well by always taking your tools with you, provided you never forget them. One day we went to an out-apiary, without any smoker, and we realized then how important a smoker is. Don't trust to memory. In your record-book have a list of the things you generally need to take; and after you are all ready to get in, read aloud the list and be sure that every thing is in the wagon, as: Hats, smokers, dinner (we never forgot our dinner), chisel, etc. Our own practice has been a sort of compromise between having a full kit of tools at each apiary and taking every thing along. If a buggy is used, it is not convenient to have very much bulk. By the way, a bad season is not without its compensations. We have had two years of such dead failure that we could make almost every trip the entire season in a buggy, for there was no honey to haul, and little in the way of supplies.

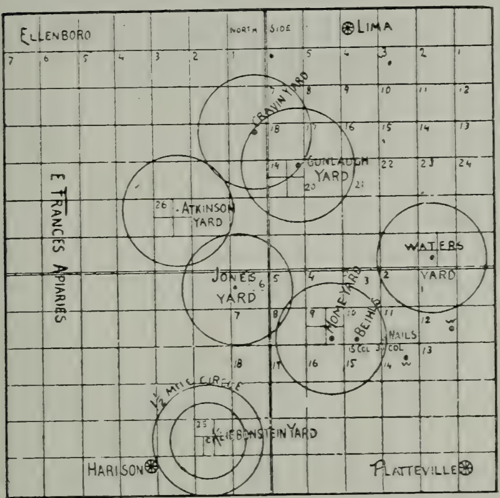
GENERAL MANAGEMENT OF OUT-APIARIES.

The ways of managing out-apiaries will be just as many as the men who manage them; but the general treatment should be about the same as at the home apiary. There will always be the advantage of moving at any time a colony or part of colony from one apiary to another, and feeling sure that the bees will stay where they are put. The more you are interested in out-apiaries the more you are apt to be interested in the prevention of swarming; and if you have been in the habit of wintering in the cellar, an out-apiary will make you debate somewhat the question whether you can not find any way of safely wintering outdoors. Some practice having a competent assistant in charge of each apiary, remaining there all the time; while others take a sufficient force of helpers to go from one yard to another—doing the work of each apiary regularly—every six days or oftener.

In *Gleanings in Bee Culture* appeared an article from Mr. E. France, of Platteville, Wis.; and as it contains so many valuable suggestions, we reproduce it here entire, with the diagram.

I have taken pains to make a correct diagram of the territory that we occupy with our bees; and I must say that I was surprised myself when I saw the exact position of each yard. They are clustered together more than I had supposed. The accompanying diagram will show how they stand, and I will give some facts and figures that will make quite an interesting study about setting out out-

apiaries and overstocking our pasture. Of course, it is impossible to locate a set of out-apiaries just so far from the home apiary, in a circle, each one in its proper place, just as nicely as we could make it on paper. We have to take such places as we can get, and many of the places that we can get won't do at all, for some reason or other; and when you have six or eight yards planted you will be likely to find, as in our case, some of them badly crowded—too much so for profit.



The circles in the diagram are three miles each, or 1½ miles from center to outside, which is a very short distance for a bee to go in search of honey. If the bees fly three or four miles, as I think they do in poor seasons, it is plain to see how it works in a poor season. The outside apiaries may be getting a fair living, while the inside yards are nearly starving. In first-class seasons, when honey is plentiful everywhere, and very few bees go over one mile, there is enough for all. I here give the number of bees in each yard this spring, the amount of honey taken, and the amount of feeding this fall to put the bees in trim for winter.

Atkinson yard. Colonies, spring count,	100
Cravin " " " "	90
Kliebenstein yard. " " "	96
Waters " " " "	88
Jones " " " "	80
Gunlauch " " " "	90
Home " " " "	105
Total	649

No increase to speak of.

Honey extracted:

Atkinson yard	190
Cravin "	200
Kliebenstein"	740
Waters "	497
Jones "	600
Gunlauch "	350
Home "	540
Total	3125

Fed back:

Atkinson yard	000
Cravin "	336
Kliebenstein"	000
Waters "	000
Jones "	210
Gunlauch "	486
Home "	900
Total	1932
Surplus after feeding	1193

Now, notice the Kliebenstein yard, how it is located away by itself, as, for instance, from other yards. It has a great advantage; and then there is plenty of basswood all around it. It has no bees belonging to other parties on its territory. It gave the most honey, no feeding, and is in the best condition of any yard for winter stores.

We will now notice the Atkinson yard. It is pretty well hemmed in on the north and east sides by the other yards, but it has an unlimited field on the west, of good pasture. We took but little honey there, but it is in good condition for winter, without feeding.

Now, away over on the east side we have the Waters yard. It is two miles from basswood, but a splendid white-clover range—plenty of basswood two miles north and east. This yard gave some honey, and required no feeding for winter.

Then there are the Cravin and the Gunlauch yards, each 90 colonies in spring, only 1½ miles apart—too close, with very little basswood north of them. Both of these yards were fed more honey than we took from them. There were a few acres of buckwheat near them that helped them a little. The Jones yard did fairly well, considering its surroundings. It had the least number of bees, an abundance of basswood near, and then had eleven acres of buckwheat just over the fence.

We will now notice the home yard. There were 105 colonies. The Jones yard is rather too close. Then there is an apiary of 20 colonies a little over half a mile east, at a point marked Beihls; another apiary 1½ miles east, 30 colonies, marked Nails; another apiary southeast, marked W, about 40 colonies. Another apiary still further to the east, and a little to the north, marked W, about 40 colonies. So you see the honey-yard territory is overstocked the worst of all, and had to be fed 360 lbs. more than was taken from them. The home yard has the best clover field of any, but basswood is scarce within two miles. In looking at the diagram, one not acquainted with the ground would naturally ask, "Why don't you use that open space southeast of the home yard?" It is all prairie land. Corn and oats don't yield much honey.

We will now just look back to the record of a year of plenty, 1886, and see how the yards averaged up then.

COLONIES, SPRING OF 1886.

Atkinson yard,	72 cols.; average lbs. per col.,	106
Cravin "	80 " " " " "	106¼
Kliebenstein"	60 " " " " "	109
Waters "	72 " " " " "	107
Gunlauch "	50 " " " " "	100½
Home "	61 " " " " "	117

Jones yard not planted then.

FOR 1885.

Atkinson yard	56 cols.; average lbs. per col.,	90
Cravin "	53 " " " " "	74
Kliebenstein "	46 " " " " "	62
Waters "	57 " " " " "	57
Gunlauch	46 " " " " "	77½
Home "	62 " " " " "	71½

FOR 1884.

Atkinson yard,	51 cols.; average lbs. per col.,	107
Cravin "	41 " " " " "	113
Kliebenstein "	51 " " " " "	109
Waters "	41 " " " " "	130
Gunlauch "	41 " " " " "	106½
Home	61 " " " " "	113½

FOR 1883.

Four yards, average for the whole........105 lbs. Number of colonies, 35, 48, 33, 60.

In 1887 we kept no record. It was a very poor season, and we got but little honey.

The year 1888 was a very poor one also.

	Cols. in spring.	Average per col.
Atkinson yard,	76	23
Cravin "	75	20
Kliebenstein "	67	31
Waters "	69	32
Gunlauch "	77	21½
Home "	66	37½

FOR 1889.

	Cols. in spring.	Average per col.
Atkinson yard,	72	40
Waters "	79	40
Kliebenstein "	87	63
Gunlauch "	79	47
Cravin "	78	49
Whig "	52	40
Home "	84	52

Now, friends, you have the figures and the map of the ground that our bees are on. Study it for yourselves. But if you plant out-apiaries, don't put them less than five miles apart if you can help it. If you are going to keep help at the separate yards, to run the bees, six miles apart is near enough; then, if the pasture is good, you can keep from 100 to 150 colonies in each place. If you go from home with your help every day, then you want to gauge the number of colonies so as to work one whole yard in one day; or if you have but three or four apiaries in all, you will have time to work two days in each. But don't go over the roads for less than a full day's work when you get there; and remember, when you are locating an apiary, that, when you are hitched up and on the road, one or two miles further travel will pay you better than to crowd your pasture. Don't overstock your ground.

Platteville, Wis. E. FRANCE.

Soon after the appearance of Mr. France's diagram, there appeared in *Gleanings* another valuable article from the pen of C. P. Dadant. It substantiates what Mr. France has said, and shows the relation that apiaries bear to each other along the banks of the Mississippi.

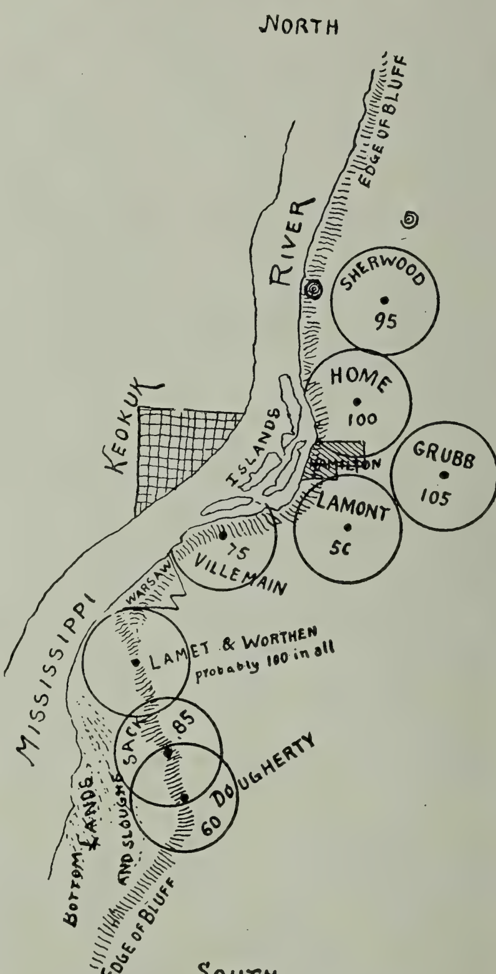
The very interesting article of Mr. France, on out-apiaries, has induced us to give you our experience in this matter, not because we can throw any more light on the question, but because our practice, which extends back to 1871, in the matter of out-apiaries confirms the views of both Mr. France and Dr. Miller, and will add weight to their statements.

Under ordinary circumstances it is not advisable to place apiaries nearer than four miles apart; but Dr. Miller is undoubtedly right when he says that the configuration of the land has a great deal to do with the greater or lesser distance that bees travel in certain directions.

In the accompanying diagram you will perceive that these apiaries are all located on land sloping toward the Mississippi River, and are separated from one another by creeks, and groves of timber land. The Grubb apiary is owned by D. W. McDaniels, who has had charge of our apiaries also for a few years past. Of all these apiaries, the Sherwood is the best in the product of both spring and fall crops, although there are seasons like the past when the fall crop fails there altogether.

The Villemain apiary has the poorest location, to all appearances; but it is located near the only basswood grove there is in the country, and has also quite a fall pasture from blossoms that grow on the islands near it. But what will you think of the Sack apiary, which is located a little over two miles south of the Lamet apiary, with another apiary close to the latter, but not shown on the diagram, and only one mile and a quarter north of another apiary of 60 colonies, owned by A. Dougherty? Yet this Sack apiary gives us the best average of honey of all, excepting the Sherwood apiary. The reason of it is, that the pasturage is all west of it on the river bottoms, and very abundant. It is probable that the bees in this apiary go as far west as the river, about three miles, while they perhaps do not travel over a mile east on the bluffs. Their course north and south, in the direction of those other apiaries, is over a hilly country covered more or less with timber which makes their flight more difficult.

The two small circles in the northern part of the diagram show the spots where we had apiaries formerly, and which, you will perceive, were further away from home than the present. At that time the Sherwood apiary did not exist, nor did the Grubb apiary; and yet we must say that we can see no difference in the yield of the home apiary. We are satisfied that the Grubb bees go east, the Sherwood bees and the home bees northeast, for their crop. When we say the bees go in a certain direction, we do not mean *all* the bees, but the greater part of them. We can give you one convincing instance of the correctness of this opinion.



The Dadant system of out-apiaries along the Mississippi River.

By glancing at the diagram you will notice that the home apiary is just about a mile and a half from the north point of an island in the river. In certain seasons the islands are covered with water in June; and after the waters recede they become covered with luxuriant vegetation, and the yield of honey from them is very large. In one of these seasons we found a colony, belonging to a neighbor, located half way between us and the river, harvesting a large yield of honey from this source, while our bees harvested nothing. Is it not evident that

our bees had not gone that far? Yet we have seen them two miles and more from home in another direction. C. P. DADANT.
Hamilton, Ill.

In 1890, and also 1897, we visited a number of extensive apiarists in the States of New York and Vermont. Among others whom we called upon was Mr. P. H. Elwood, who occupies a territory for his system of out-apiaries not many miles from that formerly occupied by Mr. Quinby. Mr. E. runs about 1000 colonies in a series of eight or ten out-apiaries, and they are located in the valleys in the midst of those York State hills. These hills are anywhere from 500 to 1000 feet high, and are covered with basswoods and clover. The former, scattered over the hills from top to bottom, prolong the duration of the honey-flow very considerably. Instead of there being only ten days or two weeks of basswood, it sometimes lasts a whole month. The first basswoods to blossom are at the foot of the hills; and as the season advances, those higher up come in bloom; so the flow does not entirely cease until the trees at the very top of the hills have gone out of bloom. The bees will commence flying on the horizontal; and as the season progresses, they keep flying higher and higher, until they have scaled the top of the hills. Beekeepers who are situated in such a country, or in swamp land, are in the best localities for honey. It might be well to observe in this connection, that these hills form excellent windbreaks for apiaries in the valleys. In Vermont, a colder climate, this feature cuts quite a figure. Mr. A. E. Manum's apiaries were located among the hills, in some cases on the sides of the mountains; but, unlike Mr. Elwood, he had no basswood there.

MOVABLE APIARIES.

Experience has shown, in many instances, that a yard which in years gone by has furnished tons of honey is now practically worthless, or so nearly so that the moving of the bees to some more favorable location is a necessity. For instance, four or five years ago an apiary furnished an abundance of basswood honey; but the basswoods have all been cut off; there is no clover and the field is worthless. Again, a locality has once furnished immense quantities of white clover; but intensive agriculture has set in, and clover pasturage has given way to immense wheat-fields. The inroads of civilization sometimes cut off the honey-resources of a locality; at other times they augment them very considerably. There are a few locations in York State that formerly gave very little honey until the farmers in recent years introducted buckwheat to such an extent that these are now splendid buckwheat countries; and the yield of this dark rich honey plays a considerable part in the net profits of the season. In a word, we want our apiaries so we can load them up at a moment's notice, and move them at practically little expense to any new field that may be more inviting. We can not always tell at first whether it will be a favorable location. If it does not come up to our expectations, we can "pull up stakes" and again try elsewhere. How are we to make our apiaries movable? Keep them on self-spacing frames, to be sure. When it becomes desirable to move a yard, all that is necessary is to close the entrance and load up the bees. See FRAMES, SELF-SPACING, and MOVING BEES.

A SCALE HIVE AT AN OUT-APIARY.

It is a well-known and established fact, that one yard may yield quite a crop of honey while another, only a few miles distant, requires to be fed. It is highly important to be able to tell just what the bees are doing at stated periods during the season. Mr. Manum kept a hive on scales at each yard; and every time he visited one he consulted the scales. If they indicated an increase of several pounds, he knew the bees in this apiary needed more room, and were also liable to swarm; but if they indicated a loss of several pounds, he inferred that the whole yard was losing likewise, and that some colonies needed to be fed. Of course, the hive on the scale should contain a fair average colony. In many cases it is not always possible to visit yards at regular periods, and so Mr. Manum had some resident near the apiary to watch the scale, and report by postal card. See SCALE HIVE.

A CAUTION ABOUT ENTERING INTO THE OUT-APIARY BUSINESS.

We have already gone over the ground of the general subject of out-apiaries, and what contributes toward making their man-

agement a success. While there are many beekeepers who have brains and capacity enough to manage a series of out-apiaries, there are also more who had better never think of entering into the subject. To be a keeper of several out-apiaries means great perseverance and a good deal of system, besides ability to manage not only the bees, but the help who are to take care of them. If you can not make fifty or sixty colonies pay in one location, do not delude yourself by the idea that you can make bees pay by establishing a series of out-apiaries. The man who can not make a small business pay probably will not make a large one do so. When you can manage successfully your home apiary, it may be profitable, as soon as the increase is sufficient, to take a part of it to an outyard.

OVERSTOCKING.—By this term we mean having more colonies in a given place than the locality can support. Our treatment of the question under OUT-APIARIES (which see) hints at benefits of restriction to 75 strong stocks in any one apiary. While, doubtless, better to retain at home unavoidable increase to the limit, perhaps, of 20 or 30 colonies, still, when 50 more than the requisite number is reached, a new yard should be started two miles away, or, better, even four.

A given locality with only ten colonies to gather the nectar in it may show a wonderful average per colony—perhaps 200 or 300 pounds. When the number is tripled or quadrupled, the average will be cut down a half. The locality should be carefully studied, and only that number of colonies be used which on an average, one year with another, will give the largest results in honey, with a minimum of labor and capital. If 75 hives during an average season would furnish an average of 150 pounds to the hive, then, perhaps, the number might be increased to 100 or even 150. When, on the other hand, the average is, say, only 50 lbs. of extracted honey, and there are only 50 colonies in the apiary, then, clearly, 50 would be all there could be kept with profit in that spot; and it could be questioned whether or not 35 might not be just as profitable, and at the same time save a little in the investment and some labor in gathering and harvesting the crop.

But in some locations, notably California, Colorado, Cuba, and in some portions of Florida, one can have as many as 300 or 400 colonies, and in some rare instances 500 colonies in one apiary. The late E. W. Alexander, of Delanson, N. Y., had some 700 colonies in one beeyard; but he had immense acreages of buckwheat and goldenrod. The celebrated Sespe apairy, in Southern California, owned by J. F. McIntyre, has, in one yard, some 600 hives of bees; but the great mountains on either side, the fertile valley, and the great abundance of honey flora, make such a number possible. See APIARIES.

OVERSTOCKING AND PRIORITY RIGHTS.

A new phase of overstocking has been developed within recent years, bringing up a rather difficult and serious problem. In good localities such as, for example, the irrigated regions of Colorado, the keeping of bees is much more profitable, or at least once was, than in some of the less favored localities in the central and northern States of the Union. It has come to pass that, in recent years, certain beekeepers, learning of the wonderful yields in Colorado, in the irrigated alfalfa regions, have started apiaries within less than a mile of some other beekeeper having 100 or 200 colonies in that locality. When the new comer establishes another apiary of 100 colonies, the place becomes overstocked, with the result that beekeeper No. 1 has his average per colony cut down very materially. There is only a certain amount of nectar in the field to be gathered; and if all the colonies get a proportionate share, then beekeeper No. 2 practically robs beekeeper No. 1 of a large percentage of honey that he would have obtained had not other bees been brought into the locality to divide the spoils. But there is no law against such a procedure. The only protection that the original squatter has is the unwritten moral law that is observed among the better class of beekeepers, to the effect that no beekeeper should locate an apiary so close to another as to rob him of a certain amount of nectar in the field which is his by priority of location. In a good many localities in Colorado, we are sorry to say that this unwritten moral law is only loosely observed. Locations that once afforded an average of 100 or 150 pounds per colo-

ry now afford, owing to this species of overstocking, only about 50 or 75 pounds.

For the other side, on this question of priority of right it may be said that the first-comer beekeeper has in no sense leased, bought, or borrowed the land growing the plants from which the nectar is secreted; that any and every one has a right to the product from the flowers. Legally the second comer has just as much right to the field as his neighbor.

We will not attempt to define moral distinctions which may be involved in this question, any more than to state that, if a beekeeper has by luck, careful observation, or at great expense, discovered a locality that yields large amounts of honey, he ought to be left in the peaceful enjoyment and free possession of his discovery, to the extent that no one else should locate an apiary nearer than a mile and a half from any of his apiaries; and right here it seems to us the principle of the golden rule ought to be used to settle such little problems; for it is practically certain that beekeeper No. 2, who comes into an already occupied field to divide the profits, would not regard with very much favor such action on the part of another if he were in the position of the one having prior rights.

P

PALMETTO (*Sabal palmetto*) cabbage palmetto, cabbage tree, or simply palmetto. —This is the most picturesque tree in all Florida. Like all the palmettos, the cabbage palmetto belongs to the order *Palmae,* and the family *Araceae.* The leaves are fan-shaped, in length about five or six feet, in width about three or four: color of leaves, bright green. The name "cabbage palmetto" is from the cabbage that forms the bud at the top of the growing trunk, and from which all the leaves grow. It grows from 20 to 30 feet high, at its best even higher, and is found in profusion along the east and west coasts, and on all river courses and hammocks throughout the southern half of Florida. In general its habitat is the southern two-thirds of the State, though it is found as far north as Jacksonville. The trunk is straight, and, as the tree ages, is bare and gray in hue, looking like a weather-beaten pine board. The wood is fibrous, and impervious to water, resisting decay when entirely submerged, though it quickly decomposes when exposed to dampness and hot sun alternately. The stems of the leaves are imbricated in the bud; and as they grow form a boot-like lacing of bark about the trunk for many feet below the top; these, the so-called "boots," gradually fall away, leaving the trunk bare, with slight perpendicular ridges, showing the fibrous corrugations, due to the nature of the wood. Its blossoming time varies according to locality. In the extreme south it begins to bloom about the first part of July; as late as August in northern portions. The blossom-stalks shoot out from the bud at the top, among the leaf-stems, and at first look like huge "blacksnake whips," only they are greenish-brown in hue. These gradually unfurl, forming a profusely flowered raceme resembling a giant ostrich plume. The resemblance to a plume is intensified when the racemes open in a mass of greenish-white petals that fill the air with a delicate aroma, as pronounced as apple blossoms. One such raceme, in full flower, is a sight to be long remembered.

The flowerets are very sensitive to atmospheric conditions. Too much dampness blights, and too dry hot air blasts the delicate blossoms. As a consequence, it can not be counted on as a good yielder oftener than one year in three, on an average. When it does yield, it is profusely. It yielded well in 1907, again in 1909, and fairly well in 1912. The roar of the bees during a good flow from the cabbage pal-

metto is like that in locust or basswood bloom. The honey is almost water-white, clear, and translucent. The aroma is distinctive, though not at all resembling that from saw palmetto. In body it is rather

Cabbage palmetto

thin, under normal, never thickening up, even in cool weather, to a very heavy consistency. In warm weather it runs almost like water. It often froths considerably on extracting—just after uncapping, in fact—though that all disappears after the honey has stood for a few days. It requires rather careful handling to keep at its best. While it does not rank as high as the honey from saw palmetto, it would still come about fifth or sixth in the entire list of honeys from Florida. The flavor is extremely mild. It is an excellent honey to "blend" with other honeys. In the vicinity of Hawks Park, Fla., it blooms almost simultaneously with the mangrove, so that the two are always secured together, never separately, in that section. Further south they are secured separately. For example, on the southwestern coast there is little mangrove, so that the palmetto honey is obtained in its purity. The combination of this honey and the mangrove, however, is, fortunately, a fine one, and won signal praise from the father of modern apiculture, L. L. Langstroth himself. Mr. W. S. Hart, of Hawks Park, had sent a sample of the blended honeys to Mr. Chas. F. Muth, of Cincinnati. Mr. Langstroth later received a smaller sample of it from Mr. Muth, and wrote him the following interesting letter:

Friend Muth:—I have delayed giving you my opinion of that Florida palmetto honey till I got the verdict of others as to its merits. In color it is unexceptionable, and its flavor is very pleasant. I am not sure but the majority of consumers will consider it the equal if not the superior of white clover. Our southern friends are to be congratulated on being able to supply our market with such a choice article.

Oxford, O., Nov. 16, 1882. L. L. LANGSTROTH.

SAW PALMETTO.

Scrub palmetto (*Sabal megacarpa*) is a low shrub with thick-set branching leaves that grow from a trunk that is long and crooked, erect early, later prostrate, and half submerged in earth. The branches, like the entire family of *Palmae,* grow from a central bud at the end of the trunk, and are imbricated in the bud. The stems, supporting the light-green fan-shaped leaves, are about four feet tall on the northern limits, but reach six or seven further south, where the plant is at its

Scrub palmetto

best. In shaded portions or damp sections, perhaps owing partly to the soil, the leaves are often bluish in color. The trunk, when it falls over, sends up fresh clusters or

clumps of shoots that form a new shrub. One trunk may thus send up many clumps of leaves resembling distinct plants, but really attached to a single trunk. The flowering blossoms are carried on a plume-like stalk that shoots out from the base of the stem at the central bud. The blossoms are generally white, creamy, at times with a half-greenish cast to them; single flowerets of the racemes small and delicate, with a decidedly sweet aroma. These single flowers on the racemes resemble somewhat the delicate "lily of the valley." It is these racemes, from two to four feet in length, that secrete the nectar. The plant grows freely on sandy soil over the southern two-thirds of the peninsula of Florida, becoming scarcer toward the northern boundaries, and smaller as well. It reaches its finest form from a line east from Tampa to the coast, southward, and flourishes on the Keys. It begins to blossom in the vicinity of Fort Myers, and Miami, about April; further north, May is the flowering time. May is the time for blossoms, about midway of the State. The edges of the stems of the leaves show on either side serrated points, or teeth, that give the name "saw palmetto" to this species. But the real saw palmetto ranges much further north, even extending into the Carolinas, and is the *Serenoa serrulata,* not the *Sabal megacarpa* (Chapman and Small). The serrations of the saw palmetto are deeper and more rasping. On the west coast of Florida, from about Tampa, north and south, the scrub palmetto extends for miles eastward in an unbroken sea of green. On the Seaboard Airline R. R. it is possible to ride for miles without being out of sight of the scrub palmetto that makes such an impressive sight, seen in such masses. Usually pine trees grow scatteringly among dense hammocks of the scrub palmetto. These form what are commonly called "the flat-woods." On the edges of heavy, damp hammocks, where the soil is richer, the scrub reaches much greater density, size, and vigor. There are still wide areas of scrub-palmetto hammocks, and flat-woods yet unoccupied by any beemen, that offer an attractive field for apiculture. There is one objection to such areas, however: The palmetto is usually the only nectar-secreting plant in such territory, and colonies have to be watched or they will run out of stores in seasons when the palmetto does not bloom. But there is no honey-plant in Florida that is more reliable, year in and year out, than the same scrub palmetto.

The product ranks among the four best honeys of the State, and, though forest fires destroy much of the bloom for that year, still the sections burned one year produce the most honey the second year, so the loss is not without some advantage. The honey is clear, amber, almost lemon-hued; body thick and waxy, and aroma exquisite. Almost all are enthusiastic over such honey, once they taste the pure article. In many localities it is disguised by the admixture of other honeys gathered by the bees either during the flow or just prior or subsequent to it. Once known, it is always popular with consumers. It candies pretty early, but not so promptly as orange honey. Mr. O. O. Poppleton pronounces it the best honey in Florida, with possibly the exception of that from white tupelo. See TUPELO.

PARTHENOGENESIS.—In the great majority of cases the sex cells disintegrate unless they unite with the products of the opposite sex of the same species; but in some cases of the animal kingdom cells are given off from the ovary, which, without fertilization, are able to undergo development. That these cells are true eggs is evident from their origin, appearance, behavior, and fate, while the only difference between these eggs and eggs requiring fertilization is that the former are able to divide and grow without receiving the stimulus given by the male sex cell. To this phenomenon the name "parthenogenesis" is applied.

The word parthenogenesis (virgin development) was first used in this sense by Professor v. Siebold in his classic paper, "Parthenogenesis in Lepidoptera and Bees," in 1856.

However, earlier writers described the phenomenon under various other names.

In 1745 Charles Bonnet described the parthenogenetic development of plant-lice; and Prof. Oscar Hertwig, the great German embryologist, designated this work as marking one of the milestones in the history of the science of development.

Just one hundred years later the Rev. Johannes Dzierzon, of Carlsmarkt, Ger-

many, put forth the theory that the drone or male bee is produced from an egg which is not fertilized. This work, published in the *Eichstadt Bienenzeitung,* may well be looked on as the starting-point of the theory of parthenogenesis, since it began a very important discussion, and marked the origin of a host of works along similar lines. Dzierzon based his views on the following facts observed by him and since confirmed by many others: 1. An unmated queen occasionally lays eggs, but these produce only drones.

2. Workers, under certain peculiar circumstances, lay eggs, but these develop only into drones. Worker bees have never been known to mate.

3. Old queens may exhaust their supply of spermatozoa received in mating, and thereafter produce only drones. As the supply diminishes they lay an ever increasing percentage of drone eggs.

While this theory is based on the work of Dzierzon, it must not be forgotten that its establishment is due in no small part to the researches of Professor Leuckart and von Siebold, of Germany.

The facts brought out in an examination of this work have an important bearing on the practical work of the apiary, and it is necessary for the queen-breeder, at least, to know the application. If, for example, a Cyprian queen is mated to an Italian drone, the resulting workers are a cross between the two races, or Cyprio-Italians. Any queens reared from this colony are also Cyprio-Italians; but the drones of this cross-mated queen are pure Cyprians, the Italian drone in the cross having no influence on the male offspring of the Cyprian mother. If, therefore, but one purely mated queen is obtained, her daughters produce pure drones, regardless of mismating, and the race may be established in an apiary.

The conclusion frequently drawn from this theory is that the queen can voluntarily control the sex of an egg by withholding or allowing its fertilization. It is sometimes further held that all eggs in the ovary are male, and the sex changed by fertilization. These conclusions are not based on observation, and proof is entirely lacking. In a statement of the theory, therefore, it is necessary to stick to facts.

The Dzierzon theory has been combated by many different scientists, most recently by Dickel, a German beekeeper with scientific aspirations. While the theory has been somewhat modified by recent work, it remains the prevalent view to-day, and Dickel generally receives the condemnation so richly deserved.

Parthenogenesis occurs in many other orders of both plants and animals, and a comparison of the various results is most interesting. Merely to cite some cases for comparison: In the bee, only males are produced parthenogenetically; in certain lepidoptera, only females are so produced; while in plant-lice and certain small crustacea, both males and females are produced from unfertilized eggs. Ants were formerly supposed to have a parthenogenetic development identical with that seen in the honey-bee; but more recent work makes this doubtful as a general statement. The silkworm is occasionally parthenogenetic.

PARTRIDGE PEA (*Chamaechrista,* senna family, also called sensitive pea).—A tough hardy weed of the Senna family, growing plentifully all over and through high pine woods of central and northern Florida, and extending into Georgia somewhat. It is scraggly in form, branching low to the ground, and reaching a length of two and three feet on good ground; limbs tough and woody when dried. The yellow flowers are solitary, sometimes slightly clustered, and the petioles have one or two glands at the base, from which the bees gather the nectar. We have seldom seen a bee on the blossoms proper. This is a peculiarity we have observed on no other plants. The stems are brown, and often branch out as low as an inch above the ground. As the branches grow they widen horizontally, sometimes lying almost parallel to the surface of the ground. The bloom period is long, lasting from July to mid-September. Unless the summer rains are too heavy and continuous, it yields nectar every season. In rainy seasons the nectar is washed out of the plants before the bees can gather it. The honey has a pretty hue, being light amber. The body is thin, even exceptionally so, and the flavor is disappointing. It is far inferior to ordinary sorghum. A good teaspoonful of pure resin or turpen-

tine would hardly shock the palate more, especially if fresh from sampling palmetto or orange honey.

The late H. W. Herlong, of Fort White, Fla., secured all his surplus from this source and chinquepin, a bitter honey. He produced almost exclusively comb honey; and, poor as the flavor is, he managed to sell his crops at paying figures. The fine appearance of the capped article doubtless was the secret of this. As an extracted honey, it is valuable only for bakers' use. It is a safe and sure crop in its locality, and quantity partly atones for lack of quality.

PEDDLING HONEY.—See HONEY-PEDDLING; also EXTRACTED HONEY.

PENNYROYAL, WILD (*Pycnothymus rigida,* small; also *Satureia rigida*).—This very interesting plant, a member of the *Lamiaceae,* or mint family, grows generally over the southern third or half of Florida, in sand and pine land. The stalks are square, with many spreading branches; the leaves are small and very numerous, stiff, and spear-like, attaching close to the stalk with almost no stems. The blossoms are light purple, with darker blotches of color on the middle of the lower lip, and are very minutely pubescent—that is, are covered with a fine furze. Undoubtedly that "Nestor in apiculture," Mr. O. O. Poppleton, of Stewart, Fla., first called the attention of the beekeeping world to the wild pennyroyal as a honey-plant. In 1882 he remarked on the quantities of the plant and the quality of the honey from it. He discovered its good points when he was on a visit at Tampa. It is just as frequent, he has discovered, on the east coast. Beginning to bloom in November or December it does not yield nectar well till after New Year's, then gradually increases its flow up to the first of March, when it generally goes out of bloom. Mr. Poppleton has secured as much as 50 lbs. per colony from this source alone. But it seems to be an erratic yielder, in good seasons producing abundantly. Any year it is a fine help in brood-rearing. It finds the hives light in honey, and, perhaps, in bees. It leaves them full of both honey and bees. The beeman so fortunate as to be in a pennyroyal district can begin extracting palmetto honey much earlier than where no pennyroyal exists. It acts much the same as fruit-bloom in the North does to the clover flow, for it allows the very first palmetto honey to go into the surplus chamber that would otherwise have to go into the brood-chamber. And so, while it is not of so much apparent commercial importance as some of the other nectars in Florida, it is in reality a much more valuable honey-plant than usually believed or known. The honey is clear, and light in color, perhaps the whitest of all honeys in the State, the body and flavor both being fine. Some beemen here maintain that pennyroyal honey is really *the* finest in the State.

PEPPER-TREE (*Schinus molle*). From Peru. This is really not a pepper-tree at all; its flowers and the honey have a peppery flavor, and the seeds resemble pepper. It is a magnificent shade-tree, and in California has been very largely planted. The honey is thick and dark, but it serves a very useful purpose in helping the bees to tide over bad times without feeding. It is under a ban now, as it is supposed to harbor injurious insects; but it seems probable these pests would still exist even if all pepper-trees were destroyed.

PERFORATED ZINC.—See DRONES.

PHACELIA (*Phacelia tanacetifolia* Benth.).—Introduced from California into Europe, where it has been highly praised both as a honey and forage plant. Some, however, deny its value as a forage plant, and not until 1904 did any Californian ever mention it as such. It has blue flowers much resembling heliotrope, the beauty of which makes it worthy of a place in the flower-garden, where the bees may be found on it in great numbers. One season in California, M. H. Mendelson extracted a carload of phacelia honey, but never before nor since has he extracted as much. The honey is stated to be amber-colered, and pleasantly aromatic in flavor. In his list of the honey plants of Texas, Scholl mentions two other species of phacelia.

PICKLED BROOD.—See FOUL BROOD.

POISONED BROOD.—See FRUIT-BLOSSOMS and FOUL BROOD.

POISONOUS HONEY.—There are cases on record, apparently authenticated, which seem to show that honey gathered from flowers of plants that are in themselves poisonous is also poisonous either to human beings or to the bees themselves, or both. Xenophon tells how, in the memorable march of the ten thousand Greek soldiers to the sea, some of them were taken seriously ill after eating poisonous honey. The facts are so carefully and minutely recorded as to leave no doubt of the honey-poisoning.

The wild honey in one or two of the Southern States, in a very few isolated localities, is reported to produce sickness, and in some instances this is so sudden and violent that it has given occasion for alarm. In certain regions of Virginia, especially near Halifax Court-house, there is grown in the mountains, quite extensively, mountain laurel. The bees are very fond of it; and while it does not seem to affect them particularly, it is dangerous to human beings, or at least so reported. The plant itself is an extremely distressing narcotic, varying in effects according to the quantity taken into the stomach. Dr. Grammer, of Halifax Court-house, reports that, during the late civil war, himself and quite a number of comrades were poisoned by eating honey from this plant. There was, he says, a queer sensation of tingling all over, indistinct vision, with an empty, dizzy feeling about the head, and a horrible nausea that could not be relieved by vomiting. This lasted for an hour or so, while the effects did not wear off for several days.

Yellow jasmine

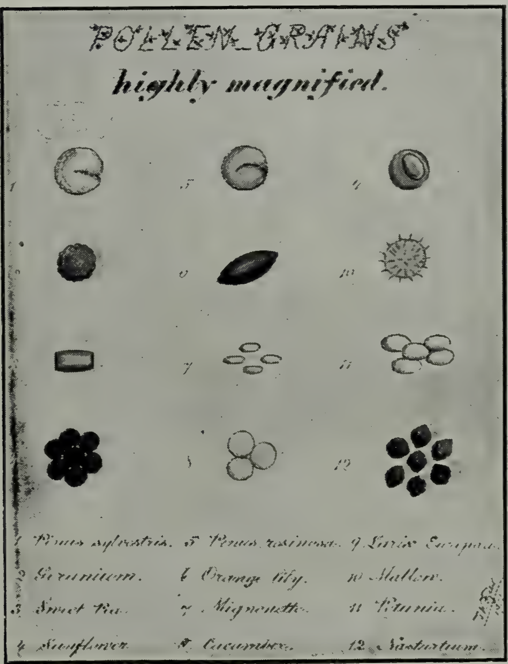
Another honey-plant yielding honey said to be poisonous is the yellow jasmine found in certain localities of Georgia, especially in the vicinity of Augusta. The roots, leaves, and flowers are all highly poisonous; and Dr. J. P. H. Brown, a beekeeper, says the honey from it is also of like character, as he knows of several persons who came very near losing their lives by eating it. In his opinion bees do not work on it from choice; for when other bloom is yielding honey at the same time, the jasmine flowers are seldom visited.

Notwithstanding these reported cases, Prof. A. J. Cook, of Pomona College, Claremont, Cal., very much doubts whether the honey from any plant is poisonous. Some years ago instances were related of beekeepers who had not only eaten of the honey from poisonous plants but ate of it quite freely without any ill effects. But the question might arise as to whether they actually ate any honey from the plants in question, *or from some harmless plants* that were in bloom at the same time. In a matter involving severe sickness or possible loss of life it would seem to be policy to err on the safe side—that is, to let the honey from mountain laurel, yellow jasmine, and other poisonous plants, entirely alone. If it does not kill the bees, let them have it for brood-rearing, but make no other use of it.

POLLEN.—Pollen is a highly nutritious food which is eagerly eaten by many insects, and is gathered in large quantities by bees as food for their brood. A pollen grain is protected by an inner and an outer coat (in a few species there is but one coat), and is filled with a semiliquid in which float many minute granules. Its contents form a complete food, consisting of proteids, substances rich in nitrogen, sulphur, and phosphorus; and carbohydrates, or starch, oil, and sugar. They thus

offer a rich supply of easily obtained food to all insects, and especially to those which are not predaceous.

Pollen grains vary in size from 1-100 of an inch in Iris to 1-3000 of an inch in some saxifrages. The number of pollen grains is also very variable but is usually large. Each anther of the peony has been estimated to produce 21,000 grains; and if there are 174 stamens to a flower there would be 3,654,000 grains. In wisteria



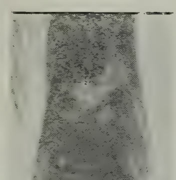
—*After Fletcher.*

there are said to be 7000 grains to each ovule. The excess of pollen is thus so large as to permit of much waste. In shape the grains may be globular, ellipsoidal, polyhedral, or of the form of a dumbell in the borage family; or in some *Polygalaceae* they have the shape of "a wickerwork basket." The outer coat may be banded, ribbed, or checkered, and beset with sharp teeth, points, spines, prickles, or knobs; and variation in the sculpturing is, indeed, almost endless. The air in the numerous little pits and hollows on the surface of the grains protects them from contact with water. The projections enable them to adhere to insects. While yellow is the prevalent color, red, blue, brown, and green hues also occur.

Doubtless you have all heard bees humming about hollyhock blossoms, and perhaps most of you have passed on thinking that it was nothing strange, for bees are always humming about flowers. Suppose we stop just a minute, and look into the matter a little. The bee, although on the wing, is almost motionless as it hovers about the dust in the center of the flower, and, by careful watching, we may see that its tongue is extended to a considerable length. The tongue looks much like a delicate pencil-brush as it sweeps about among the grains of pollen; and as the pollen adheres to it and is from time to time put away somehow, we are led to infer that there must be something adhesive on it. We believe the bee, when it starts out to gather pollen, carries some honey if it finds any in the blossom. Well, we will suppose it has moistened its long, flexible, brush-like tongue with honey,* has spread it out and brushed it among the pollen-grains and then—right here we shall have to give you some pictures to explain what happens next.

The illustrations shown on the next page, taken from Cheshire's Bees and Beekeeping, show the leg of the bee.

In a general way it will be noted that the legs are covered with rough hairs, fringes of coarser hairs, and short spines or combs. These are located on the different parts of the legs of the bees, and each set is designated for a different purpose; *ti*, at A, in the reproduction from Cheshire, shows a pollen-basket on one of the hind legs. Notice that the joint at this point is hollow and fringed on either side with coarse hairs or spurs. The pollen, as fast as it is gathered and made up into little pellets, is deposited one at a time, forming one large loaf or pellet in the pollen-basket—*ti* at A, but reference to this will be

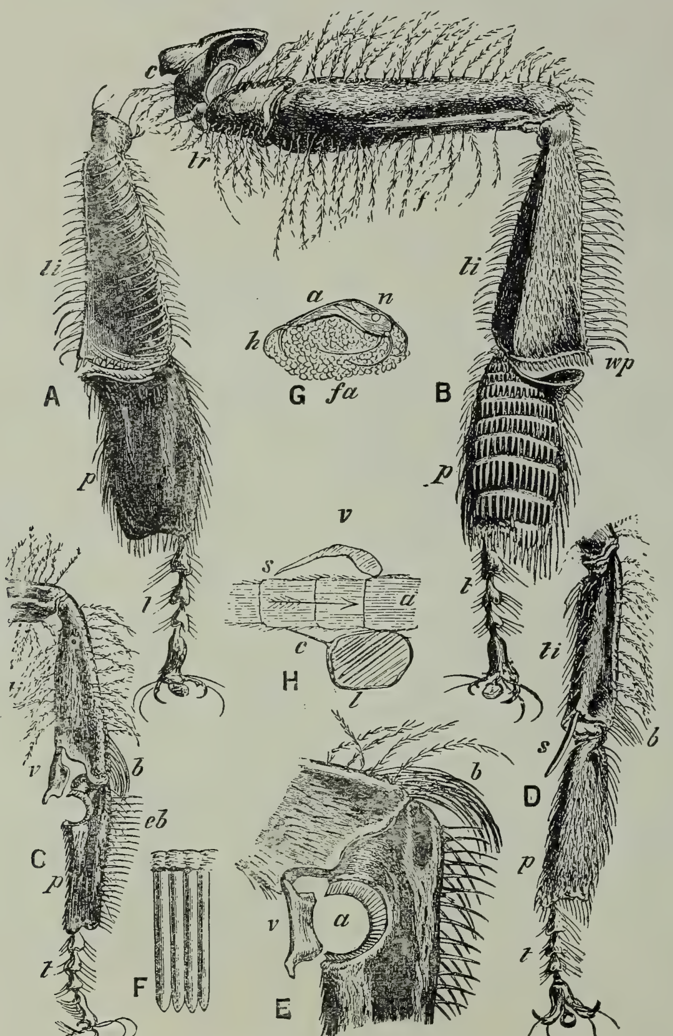


End of tongue of worker, magnified 70 times.

* It seems more probable that this moisture is a gland secretion, for honey is never thrown out on the tongue. (Careful watching has never revealed it in any part of honey ripening and storing; and if never then it is a reasonable assumption to say never at any time.)—A. C. M.

made a little later. Just below the pollen-basket at *wp,* in B, is shown a sort of jaw, or pincers. This is said to be used to gather the thin plates of wax that are secreted on the under side of the body of the bee, and that the pincers form them so that they can be handled by the fore legs and deposited in the comb.

well as on the legs, seems to become coated with pollen. This is removed by the brushes and combs on the legs of the bees. In some manner the combings of pollen dust are gathered into very small pellets which are then transferred from the fore legs to the middle ones, and from the latter to the pollen-pockets on the rear legs.



The legs of a bee. From Cheshire.

Below these jaws, or pincers, at B, will be found a series of combs, or spines, on the inner side of the legs. On the same joints of the other legs these seem to be absent, and in their place long stiff hairs appear more to serve the purpose of a brush. When the bee goes into a flower, especially one with a narrow opening, the hair on the thorax and on the head, as

By watching closely one can see the middle legs patting the pollen on the back ones, making quite a loaf of bee-bread for each leg.

It is probable, also, that the tongue is an important organ for gathering pollen-grains as well as nectar, for it seems to be fringed with fine hair on which pollen dust might readily lodge. Just how the

Bees with masses of pollen on their legs.

bee cleans its tongue it is difficult to see; but the brushes on the fore legs are evidently designed for the purpose of rolling off these grains which possibly contain a little honey or nectar. In any event, they are transferred to the middle legs from the fore legs, and from the middle legs to the pollen-basket in a way that leaves sleight-of-hand clear in the shade unless one watches the whole operation with a powerful glass. This transfer seems to go on in the blossom and even after the bee is on the wing. Dust the bee all over with flour and it immediately begins the process of "brushing its hair." It will rub the palms of its legs and then begin the work of combing itself, reaching with its middle and fore legs over its back and cleaning its antennæ with its fore legs. All these maneuvers may take place while it rests on some object or while on the wing. On entering the hive it is cleaned by other bees, when after a little it will be brushed and groomed, until every particle of pollen has been removed.

Masses of pollen taken from legs of bees. These were photographed with a thimble to show the relative size.

If one desires to witness some of these comical sleight-of-hand performances, for, indeed, they are little short of real legerdemain, he needs to dust only a few bees with common flour and note what happens.

Reference was made to the fact that the bee cleans its antennæ with its fore legs.

Pollen masses on legs of bees.—*Photo by E. F. Bigelow.* Several show side hairs (like stakes on a hay-wagon) to hold the load.

If these delicate organs of sense and hearing be in any way impeded by a smearing of pollen the bee is unable to communicate with its fellows or perform satisfactorily the functions of the hive. See SCENT OF BEES. By referring to the cut, E, p. 430, cut by Cheshire of bees' legs, there will be found a little notch at *a*. Just over this notch is a spur, or cap, *v*. The same thing on a smaller scale can be seen at C. This opening is fringed on the inside with a row of hairs, an enlarged view showing at F. It will be noted that this cleaner is located, we might say, in the "elbow" of the fore legs, and within easy reach of the antennæ. If flour is dusted upon these organs the bee will immediately slip this notch over the antennæ, push *v* over to place, cleaning every portion of the antennæ at two or three sweeps. Some have thought that the same device is used for cleaning the tongue in a similar manner, but this is hardly probable. The tongue, unless at the extreme end, is too large to go in this opening. If it could be used for cleaning the tongue the delicate cleaner would become smeared with honey, and thus what would appear to be its primary function as an antennæ-cleaner would be destroyed.

When a bee gets into the hive (if a young bee), it may go through with a series of rejoicings—see BEES; but if a regular laborer, it proceeds at once* to deposit the pollen in the cells. This is done very quickly by crossing its pollen-legs while they are thrust to the bottom of the cell, and then kicking the loads off. After unloading, it starts out again without paying any further attention to the matter.

After the pollen is dropped in the cells, it will fall out if the comb is turned over; and when the maples are first out in the spring, we have heard and seen pollen rattle out like shot, in turning the combs horizontally to look at the queen. Very soon after pollen is thus deposited, other bees come and mash it down into a hard cake. See BEE BEHAVIOR.

NECESSITY OF POLLEN FOR BROOD-REARING.

We are interested about pollen, because bees can not rear brood without either that or some substitute for it. Bees kept in confinement, and fed on pure sugar and pure water, will thrive and void little or no excrement; but as soon as pollen, or food containing the farinaceous element, is given them, their bodies will become distended; and instead of a transparent fluid they will void a liquid of a darkish tint which will soil their hives and emit quite an unpleasant smell. We once kept about 300 bees in a cage with a queen, and gave them only pure sugar and water. They built comb, and seemed quite contented, the cage emitting no smell whatever. In order to start brood-rearing we gave them some sugar candy containing flour, and they soon became uneasy and tried in vain to get out. At this time the cage gave off quite an unpleasant smell, and so they were allowed to fly. Had the pollen element not been given them, it is probable they could have endured the confinement a month or more. We once wintered a fair colony of bees on stores of pure sugar syrup, and when they flew in the spring there was no perceptible spot on the white snow about their hives. They had no pollen, and so, of course, no brood-rearing could go on without it. A few years ago we made some experiments with bees confined in a large room under glass. As it was late in the fall, after brood-rearing had ceased, we did not know whether we should succeed in starting them again. After feeding them for about a week, eggs were found in the cells, but none of them hatched into larvæ. A heap of rye meal was placed in the center of the room near the feed, and anxiously we waited to see them take notice of it. After several days a bee was seen hovering curiously about it. In breathless suspense we watched it until it finally began to dip its tongue into the heap, and then to pad it on its legs. It carried home a small load. We had the hive open, and the frame out, as soon as it was among its comrades, and watched the behavior of the rest while it shook itself among them, until it deposited its treasure in a cell, and hurried away for another load. Very shortly some of the rest followed it, and buzzed about the room until they found where it was loading up, and soon they were at work on the meal, as merrily as in spring. Of course, the eggs were very soon, now, transformed

* It depends largely on whether pollen has only just begun to come in or not. Bees are very fond of fresh pollen, and it is no unusual thing for a bee to be stripped of most of her load before she can put it in a cell.—A. C. M.

into unsealed larvæ,* then into capped brood, and, in due time, we had young bees hatched out in the month of December.

By warming the room with a stove for several days in succession, we found we could start brood-rearing and pollen-gathering even in the month of January. It may be well to state here, that, although we succeeded in rearing bees in midwinter, as strong and healthy, apparently, as those raised in summer time, the experiment was hardly a success after all; for about as many bees died from what we suppose was the effect of confinement as were hatched out. It was a decided success in determining many unknown points in regard to bees, aside from the office of pollen; and we presume, if it ever should be necessary, we could overcome the difficulties of flying bees under glass. Under the head of FRUIT-BLOSSOMS will be found further facts on this matter.

ARTIFICIAL SUBSTITUTES FOR POLLEN.

It has been known for many years, that in the spring time bees will make use of the flour or meal of many kinds of grain, and many beekeepers feed bushels of it every season. The favorite seems to be rye; and as the bees are apt to fall into it and sometimes get so covered as to perish, we have been in the habit of having the rye ground up with an equal quantity of oats. A great many plans have been devised for feeding it without waste; but, after all our experiments, a heap of meal on the ground is about as satisfactory as any way. Of course, it should be protected from rain; and as there is usually much high wind in the spring, which is, to say the least, very annoying to the bees, it is well to have it in a spot sheltered as much as possible, always aiming to give them as much sunshine as may be. By way of experiment, we have concentrated the rays of the sun on the meal heap by mirrors, that the bees might work on days otherwise too cold; we have also made glass-covered structures for the purpose, and have even kept their meals hot by means of a lamp; all these plans have succeeded, but we are inclined to doubt whether stocks pushed along in brood-rearing, by such means, were really in advance of some that were left to take their chances. It is amusing to see the little fellows start from their hives on days so cold that they would not otherwise stir out, hie to the warm meal and load up, and then go home so quickly that they do not have time to get chilled.

Is there any danger of feeding them too much meal? There is. Reports and our own experience have shown that bees will sometimes get their combs packed with this inferior substitute for the real article; and we would advise giving it only during those seasons when there seems to be a lack of natural pollen. As a general thing, nature supplies bees with all the nitrogenous food they require, and quite early enough. If rye meal be given on a warm day when the bees can fly in mid-winter they will store some of this meal and start brood-rearing; then when cold weather comes on again, the brood is deserted and dies. Nature, on the other hand, will not supply this food before the proper time for brood-rearing to come on. But the question may arise, "How is the owner of the bees to know when nature is not supplying them a farinaceous diet?" If the bees seem to be hovering around chicken-houses, barns, and stables, then it is apparent that they are not getting sufficient pollen to feed, and they should be supplied artificially as already explained.

Not a few of our readers have been perplexed and astonished, doubtless, by seeing the bees, in early spring, greedily appropriating sawdust, just as they do rye meal. We have seen them at the saw-mills, so thick on a large heap of fresh sawdust as to attract a large crowd of people; and when we caught them, and tasted of the pollen from their legs, we were somewhat amazed to find it sweet and very much like pollen from the flowers. They doubtless had plenty of honey but no pollen, and these fine particles of wood contained enough of the nitrogenous element to answer very well, mixed with honey, as they have it when packed in their pollen-baskets. The pollen substitute from common sawdust contains an essential oil, besides some gummy matter, that gives an odor doubtless reminding the bees of the

* As expressed, the inference is that *eggs* will not *hatch* unless the bees have pollen. It is possible that the pollen may have caused the bees to be more active and raise the temperature, but it of itself could have no effect on the hatching.—A. C. M.

aroma of opening buds. Not only do they thus collect (to us) tasteless sawdust, but they have been found at different times on a great variety of substances. A friend in Michigan at one time found them loading up with the fine black earth of the swamps, and they have been known to use even coal-dust; but the strangest thing of all was told us by the owner of a cheese-factory near by. He said the bees were one day observed hovering over the shelves in the cheese-room, and, as their numbers increased, they were found to be packing on their legs the fine dust that had accumulated from handling so much cheese. Microscopic investigation showed this dust to be embryo cheese-mites, so that the bees had really been using animal food as pollen, and living animals at that. If one might be allowed to theorize in the matter, it would seem this should be a rare substance to crowd brood-rearing to its uttermost limit.

HOW TO START BEES AT WORK ON RYE MEAL.

A beginner hears the feeding of oatmeal highly recommended as a substitute for pollen. He places some near the entrances of the hives, but not a bee touches it. He is told again to wait until early spring, before the bees have access to natural pollen, and then they will take it. He does so, but, as before, not a bee notices it. He is next told to put a heap of it in the sun, a few rods distant from the hives. This time he may succeed; but it would not be strange if he should once more report that his bees would have nothing to do with it. Finally he is directed to take a piece of honey and get some bees to feeding on it, then to set it on the heap of meal.* The bees soon gather over it in great numbers; those who go home loaded start out many more searching all about the vicinity, to see where the treasure comes from. The hum of the busy ones on the honey soon attracts them, and, in snuffing about the pile of meal, some bee discovers that it can be used as a substitute for pollen; the others soon follow suit, and, in a little time, both the bees and their owner are happy, and the pile of meal quickly disappears. After this he never has any more trouble in getting the bees to work on meal, for he *knows how.* The bees and their owner have both learned a valuable lesson about pollen. Is there any very great difference in the way they have been taught? Did they not both learn by practical experiment?

BEES ROBBING ARTIFICIAL POLLEN FROM BARNS AND STABLES.

There are times when bees will not only find sawdust but delve down into chop feed for cattle. On such occasions they will raid barns, stables, and chicken-houses in a way that seems almost like a regular case of robbing. In the spring of 1909 numerous reports from all over the country told how bees had invaded premises of farmers, driving cattle out of the stables, and causing annoyance generally. One of our own neighbors telephoned us one day, saying that a swarm of bees had taken possession of his chicken-house, and that he would like to have us come and take the bees out. Investigation showed there was no swarm, but the inside of the building was filled with bees. At first we were inclined to think that syrup of some kind had been stored there, as it looked like a genuine case of robbing; but a careful examination of the floor where the chickens had been fed showed the desire of the bees for nitrogenous food was so great that they had invaded this chicken-house and helped themselves to the bran and screenings.

A few days later a farmer located near one of our outyards complained that our bees had taken possession of his cow-stables, saying that the cows were stung, and that it was impossible for man or beast to enter the barn. We sent a man down to investigate, and he found, as in the former case, that the bees were after chopped feed.

The spring had been very peculiar—so peculiar, in fact, that warm weather came on without any natural supply of pollen. The time for rearing brood had come; and the poor bees, through dire necessity, were

* Even this does not always suffice; but if a little lycopodium powder—just a spoonful—be scattered on the meal the bees will very quickly begin work. They seem passionately fond of this powder, which is the spores of a club-moss, *Lycopodium*, those beautiful evergreens so much used for Christmas decorations. It is often adulterated with pine-tree pollen, which of course does not hurt it for the beekeeper. If one desires he may cut the tassels from a lot of corn just when the pollen begins to drop, and lay these on papers in some dry room. In a week or so they may be put in a box and saved for the following spring, and used as directed for lycopodium. They contain sufficient pollen to start the bees on the meal.—A. C. M.

compelled to help themselves to any thing they could find. When a few of their number found a substitute for pollen they were wild with excitement, and rushed pell-mell into every stable and barn where there was any trace of meal of any sort. It is in seasons like this that the apiarist should be forehanded enough to supply them with all the rye meal they can use. But this supply should be cut off just about as pollen from natural sources begins to come in.*

During that spring a great deal of dead brood was reported, and it was believed at the time to be due to a lack of nitrogenous food.

POLLEN IN SECTION BOXES AND COMB HONEY.

We do not mean to convey the idea that we should be satisfied with pollen in our honey, for a very good and useful thing is sometimes a very bad one, if out of place. When pollen or meal is brought into the hive, it is taken at once, very near the brood; in fact, it is placed in the comb opposite, if possible. When opening hives in the spring, we find pollen scattered all through the brood-combs to some extent; but the two combs next the two outside brood-combs are often a solid mass of pollen. Should a few stormy days intervene, however, this will disappear so quickly that one who has not witnessed the rapidity with which it is used in brood-rearing would not know how to account for it. When it is gone, of course the brood-rearing must cease, although the queen may continue to lay. The amount of brood that can be reared by keeping a stock supplied with pollen artificially, during such unfavorable weather, is a very important item where rapid increase of stock is desired.

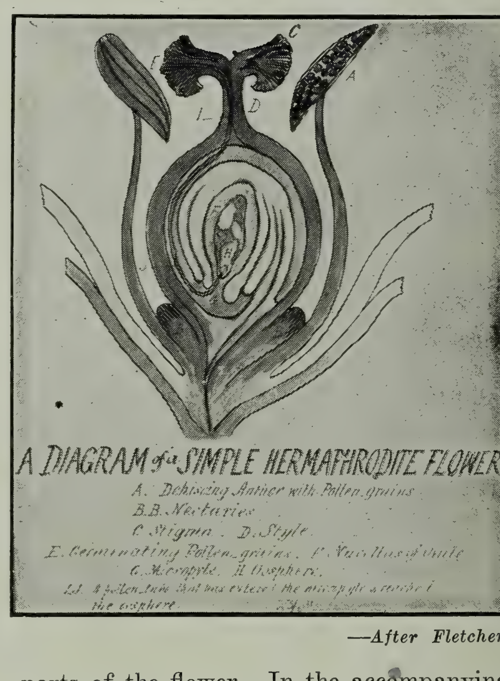
Some of those who use shallow hives have complained that pollen would go up into the sections. It has been claimed by the users of shallow frames that this can be usually obviated by putting a comb of pollen in the brood-nest.† The presence of this below will usually induce the storage of more pollen in the same place, leaving the sections clear for the storage of honey only. The same principle will apply of course to deeper hives; but it is very seldom that pollen will be found in the sections where the brood-nest is as deep as the Langstroth. It is where there is less depth that there is danger.

QUEEN-EXCLUDING HONEY-BOARDS DO NOT NECESSARILY EXCLUDE POLLEN.

It is said that the strips of perforated zinc in the slatted honey-board will largely prevent the storage of pollen above. From what experience we have had, we are inclined to think the zinc will discourage it to some extent; but if contraction be carried too far, the bees will put the pollen where they please, zinc or no zinc.

For a further consideration of this subject see FRUIT-BLOSSOMS also.

POLLINATION OF FLOWERS.—Before we consider the wonderful little schemes by means of which flowers are pollinated, we should become acquainted with the names of the different organs or



—*After Fletcher.*

parts of the flower. In the accompanying illustration we have a figure of what is known as an hermaphrodite flower—that is, one containing both stamens and pistils. Many of the specimens shown deviate from a perfect flower. If some common flower, as a rose or buttercup, is selected for examination, it will be seen to consist of numerous small thread-like

* Indeed, it will be found that bees will disregard the substitute as soon as pollen can be had. —C. C. M.

† I seriously question this.—C. C. M.

organs surrounded by two whorls of leaves. The outer circle of leaves is green, and forms the calyx, or cup, each leaf of which is called a sepal. The office of the calyx is to protect the inner and more delicate organs, especially in the bud, when the calyx alone is visible. The second circle of leaves is large and bright-colored—red, white, or yellow in the rose, and yellow in the buttercup; this is the corolla, or little crown, and each leaf is known as a petal. The brilliant hues of the corolla are designed to attract the attention of insects. Within the corolla are the stamens, composed of slender stems, and the filaments, bearing the four-celled anthers, which contain fine grains of powder known as pollen. In the center of the flower stand the pistils. Usually a pistil consists of three parts—the ovary, style, and stigma; but the style is sometimes wanting. The base of the pistil is the ovary, and is a capsule containing the nascent, unfertilized ovules; the style is a porous stalk rising from the ovary, and bearing at its upper end a glutinous receptive surface called the stigma. Pollination is the transference of pollen from the anthers to the stigma. If the pollen is from the same flower it is self-pollination; but if from a different flower of the same species it is cross-pollination. Cross-pollination between the flowers of different species is hybridization.

Soon after a grain of pollen has lodged on the stigma, if the proper conditions exist, it sends out a slender tube which grows down through the porous style, by which it is nourished, until it comes to one of the ovules in the ovary. It enters the ovule by a little orifice (micropyle, meaning little gate), and there passes from the end of the tube a male cell or germ, which unites with an egg cell in the ovule—this is fertilization. Fertilization does not always occur immediately after pollination; for instance, the flowers of witch-hazel are pollinated in the fall, but fertilization does not occur until the following spring. It would be well to bear in mind these botanical terms in the descriptions which follow, in order to understand how beautiful and perfect is the design in nature in bringing about cross-pollination.

Before we consider a few of the mutual relations of flowers and insects for the purpose of ensuring cross-pollination, something should be said about the importance of crossing, both in the animal and vegetable kingdom. The effects of self-fertilization and cross-fertilization were first clearly pointed out by Charles Darwin. He was experimenting with two beds of toad-flax, or butter-and-eggs (*Linaria vulgaris*), one set being the offspring of self-fertilization and the other of cross-fertilization. The plants had been raised for the purpose of studying heredity, and not the results of cross-breeding. To his astonishment he observed that the plants which were the result of cross-breeding were far more vigorous than the others. He temporarily abandoned all his other investigations and devoted himself to making numerous experiments in interbreeding, and to acquiring information as to the practical experience of horticulturists and breeders of animals.

As the result of his inquiries he laid down the general law that no species of animal or plant can fertilize itself through numberless generations, and that an occasional cross is indispensable. The evil effects of interbreeding had, indeed, long been known in a general way, and are even instinctively recognized by barbarous races. The deterioration goes on so slowly at first that it is not easily discovered; but finally results in loss of size, vigor, and fertility, and may be accompanied by deformity. The good effects of intercrossing are immediately manifest. When plants were crossed, their offspring were larger in size, grew more vigorously, bloomed a little earlier, and yielded more seed than their parents. The two parent plants, or animals, must not, however, be exactly alike. Since then, says Dr. Fletcher, endless observations have confirmed the accuracy of Darwin's law, and it has been found that, in the vast majority of plants, special appliances exist which will secure more or less frequent intercrossing.

A summary of the more important ways in which self-pollination and consequently self-fertilization are prevented in plants is given in the following table.

A. SEPARATION OF STAMENS AND PISTILS BY SPACE.

1. Stamens and pistils in different flowers, but on the same plant.

2. Stamens and pistils in different flowers and on different plants.

3. Stamens longer than the pistils, or pistils longer than the stamens.

4. Stamens bent away from the pistils, or pistils bent away from the stamens.

B. SEPARATION OF STAMENS AND PISTILS BY TIME.

1. Anthers mature before the stigmas.
2. Stigmas mature before the anthers.

C. MECHANICAL SEPARATION OF THE STAMENS AND PISTILS.

1. Absolute separation. Anthers or pollen masses held in a fixed position, and never set free unless the flower is visited by insects.

2. Partial separation. Self-pollination may occur during the latter part of the blooming period.

D. PHYSIOLOGICAL SEPARATION OF THE STAMENS AND PISTILS.

1. Stamens aborted in some flowers, pistils in others.

2. Pollen from a different flower prepotent over pollen from the same flower.

3. Pollen from the same flower is sterile or impotent on the stigma.

But while there is wide provision for cross-pollination among flowers, they very generally retain the power of self-pollination, so that, in the event of the failure of cross-pollination, before the period of blooming closes self-pollination may occur. The more common ways are as follows:

a. The stamens lengthen, contract, or bend so that the anthers touch, or drop pollen on the stigmas.

b. The pistils lengthen, contract, or bend so that the stigmas receive pollen from the anthers.

c. If lobed, the lobes of the stigma roll back so that they touch the anthers.

d. The filaments and styles become twisted together.

e. The corolla in wilting closes, causing the stigmas to be pollinated.

f. Self-pollination caused by the growth or movement of the petals.

g. Change in the position of the flower caused by the curving of the flower-stalk.

But while there are many plants in which self-pollination is a secondary result, there are also many which are regularly self-pollinated, and, consequently, self-fertilized. When the flowers expand, the anthers rest directly against the stigma, which thus necessarily receives the pollen. Many plants produce, besides conspicuous flowers, small green flowers, which never open, and which (though invariably self-fertilized) are very fertile. Many of these self-fertilized plants are very common, very vigorous and fertile, and extend over a large portion of the earth, as the chickweed, shepherd's-purse, and doorweed. They prove conclusively that, though nature may abhor *perpetual* self-fertilization, she does not abhor self-fertilization. On the contrary, it is a most valuable principle which is carefully preserved, and upon which the plant world is largely dependent. The contrivances, says Kerner, to bring about self-fertilization, are no less numerous than those which favor cross-pollination. "That flowers should be adapted at different times to two such diverse purposes as cross and self pollination is one of the marvels of floral construction."

These facts have led certain botanists to question Darwin's conclusions as to the evil results of continual self-fertilization, and to assert that the good effects of intercrossing are only a temporary stimulant and are not permanent. In only about five cases did Darwin carry his experiments beyond the third generation. In the opinion of Henslow, self-fertilized plants are best fitted to survive in the struggle for life. To sum up, he says they are very numerous, increase very rapidly, are very vigorous, flourish in the most neglected ground, and, being independent of insects, are best able to establish themselves in foreign countries, and are, therefore, of world-wide distribution.

It should, however, be noted that the forms which are continually self-fertilized are admittedly degraded or retrogressive species, or at least are not advancing in development. Like certain groups of animals they are adapted to certain places or conditions in nature where they appear able to maintain themselves indefinitely. But for races of plants which are rapidly evolving, cross-fertilization appears to be essential. Darwin showed that, when the offspring of cross-fertilization were brought into competition with the offspring of self-fertilization, the former always gained the mastery and survived. It would, therefore, appear that intercrossing in an advancing race of plants would be indispensable in enabling it to overcome its competitors.

Flowers according to the ways in which they are pollinated are divided into three groups.

Flowers pollinated by the wind (*Anemophilae,* wind-lovers).

Flowers pollinated by water (*Hydrophilae,* water-lovers).

Flowers pollinated by animals (*Zoidiophilae,* animal-lovers).

Flowers pollinated by animals may again be subdivided into

Snail-pollinated flowers (*Malacophilae*).

Bat-pollinated flowers (*Chiropterophilae*).

Bird-pollinated flowers (*Ornithophilae*).

Insect-pollinated flowers (*Entomophilae*).

Flowers pollinated by insects are divided into:

Flowers visited by miscellaneous insects, fly-flowers, moth-flowers, butterfly-flowers, bee-flowers, bumblebee-flowers, wasp-flowers, ichneumon-fly flowers.

Flowers may be divided into pollen flowers and nectar flowers according as they contain nectar or only pollen; or they may be divided into flowers with the nectar fully exposed, partly concealed, or deeply concealed.

Flowers pollinated by the wind.—If individuals and not species are considered, there are more plants pollinated by the wind than in any other way. The cone-trees (*Coniferae*) are all wind-pollinated. Vast forests, covering many millions of acres, of pine, spruce, cedar, larch, and fir occur in the north-temperate zone of the Old and New World. Pollen is produced in enormous quantities. Sometimes it rises in clouds, and is mistaken for smoke; the air is filled with myriads of grains which powder the foliage of the trees and even the ground. The so-called "showers of sulphur" are the falling pollen grains of the cone-trees.

In all the *Coniferae* the stamens and ovules are in different cones. Cross-pollination is here, therefore, an invariable rule, and furnishes a strong argument in favor of intercrossing. There is no stigma, style, nor ovary; but the ovules are unprotected, except by the scales of the cone, and the pollen comes directly in contact with them, instead of being deposited upon a stigma; hence the name *gymnosperms,* or naked seeds. The young cones are often very handsome, and are colored red or purple, or the scales, as in the fir, may be a very delicate shade of green.

Wind pollination existed long before insect-pollination, for fossil cone trees are found in the rocks long before there is any evidence of the existence of the true flowering plants. The wind offers an excellent medium for intercrossing. It levies no toll for its services, and it is seldom that there is not sufficient air stirring to carry pollen. In the pines the grains of pollen are provided with little wings. A gentle breeze is much better than a strong wind, which sweeps the pollen away too quickly and too forcibly. When the weather is stormy (and this is often the case when the wind is high) the anthers do not open; and if they have already dehisced they close again to protect the pollen.

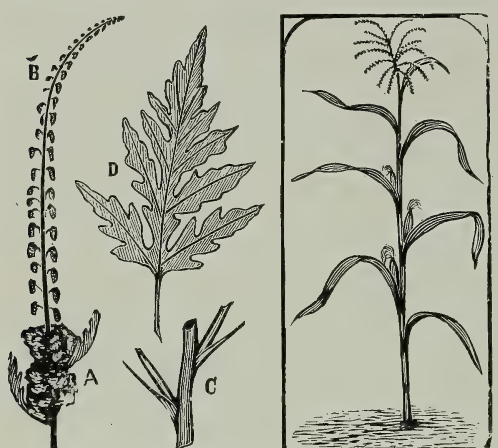
It is better not to apply the name flower to the cones of the *Coniferae.* It is true that Asa Gray and the older botanists often speak of "the flowers" of the fir and pine; but botanists are not agreed as to what constitutes, among the gymnosperms, a flower and what an inflorescence, or flower-cluster. There is, moreover, no stigma, style, or ovary, but the ovules are borne on an open leaf or scale called a carpel. The word "flower" should, therefore, be restricted to the higher flowering plants or angiosperms.

The grasses, sedges, and rushes are also all pollinated by the wind with the exception of a few cases of self-pollination. In all parts of the world grass clothes the land; "should its harvest fail for a single year famine would depopulate the earth." Who would even attempt to estimate the countless host of flowers! Many species bloom at dawn, when the sun is just rising above the horizon, when, their anthers loaded with pollen, they exhibit an attractiveness very different from their appearance at noonday. The stamens and pistils often occur in the same flower; but self-pollination may be prevented by the stigmas ripening before the anthers. Common corn is an illustration of a grass which has the stamens and pistils in separate flowers. The blossoms that bear the seed are low down, and are what we commonly term the ear; the pistils are the silk. The flowers that bear the pollen are at the very summit of the stalk, and are known as the spindle. When ripe the pollen is shaken off and falls on the silk below, or, what is still better, it is wafted by the wind to the silk of neighboring stalks, thus preventing inbreeding.

Very many deciduous-leaved trees and bushes are wind-pollinated, as the alders, birches, oaks, hornbeams, elms, walnuts, hickories, and beeches. Usually the stamens and pistils are in different flowers, either on the same plant or on different plants.

Trees the world over more often have the stamens and pistils separated, and consequently the sexes, than herbaceous plants. Anemophilous trees bloom in early spring before the foliage has appeared, in order that the leaves may not intercept and waste the pollen.

Many coarse homely weeds are pollinated by the wind, as pigweed, ragweed, nettle, hop, pondweed, sorrel, dock, hemp, and rue anemone. Their flowers are small and



Ragweed and corn, showing the two kinds of blossoms on one stalk.

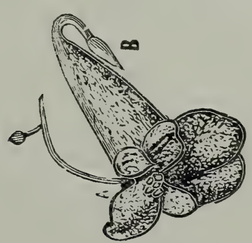
green or dull-colored. The common ragweed (*Ambrosia artemisiaefolia*), also sometimes called bitterweed, bears two distinct and entirely unlike flowers. On the ends of the tall racemes, as at B, the pollen-bearing blossoms are seen very conspicuously; and many of you who are familiar with the weed perhaps never imagined that it had any other blossom at all. If so, will you please go outdoors and look at them again? Right close to the main stem, where the branches all start out, you will find a very pretty little flower, though it possesses no color except green. These little green flowers bear all the seeds, as you will see on some of the branches where they have matured. Now, if you will get up early in the morning you will find that these flowers, when shaken, give off a little cloud of fine green dust, which is the pollen of the plant of which we have been speaking. As these plants are in no way dependent on bees for the pollination of their blossoms, they contain no nectar. During two seasons, however, we have seen bees busily engaged in gathering pollen. Both the ragweed and the corn insure intercrossing with other plants of the same species. A stalk which succeeds in pushing itself above the others, and producing a profusion of pollen, will probably be the parent, so to speak, of a multitude of the rising generation. This process repeated for generations would develop a tendency in corn and ragweed to send up tall spires, clothed with an abundance of pollen-bearing blossoms. The tallest plants also are most likely to shed their pollen on the neighboring plants, and this, too, fosters the tendency mentioned.

Flowers pollinated by water.—Flowers pollinated by the agency of water are comparatively rare. There are, however, four common species, two growing in salt water and two in fresh water, which deserve mention. The two marine species are ditch grass (*Ruppis maritima*) and eel grass (*Zostera marina*), both of which are very abundant in shallow streams and bays along the eastern coast. The two freshwater forms are waterweed (*Elodea canadensis*) and tape grass (*Vallisneria spiralis,* which grow in ponds and canals throughout much of eastern North America. Tapegrass is also called "wild celery" because it is the favorite food of the canvas-back duck. The pollination of tapegrass and waterweed is so very remarkable that it must be briefly described. The flowers are diœcious, that is, the staminate and pistillate flowers grow on different plants. Both kinds of flowers are formed under water near the base of the plants. The pistillate rise to the surface, upon which they float, anchored by a long thread-like stem. The staminate flowers while still in bud break away from their stems, and rise to the surface, where they float about like little boats. Presently they expand; and when they drift against a pistillate flower the anthers come in contact with the broad leaf-like stigmas and pollinate them. Then the fertile flower is again drawn down into the water by the spiral coiling of its stem, where its fruit is matured.

Flowers pollinated by birds.—In Brazil there are many hummingbirds and honeysuckers which visit a great number of flowers and play an important part in their pollination. The color of bird flowers is almost invariably scarlet, crimson, or bright red. The only bird in North America which visits flowers is the ruby-throat-

ed hummingbird. The cardinal flower, the scarlet-painted cup, the trumpet honeysuckle, and the trumpet-creeper are common hummingbird flowers. The nectar in these flowers lies at the bottom of long tubes, where it is beyond the reach of hive-bees, yet the cardinal flower is sometimes listed by mistake as a honey plant. The wild columbine and the spotted touch-me-not are also very often visited by hummingbirds, but they are likewise much frequented by bumblebees, to which they seem better adapted than to hummingbirds.

Honeybees obtain both nectar and pollen from the flowers of the spotted touch-me-not. Did you ever notice the spot of fur, or down, on the back of the bee, just between the wings? Well, bee-hunters sometimes put a small drop of white paint on this spot, so that they may know a bee when it comes back. Several years ago bees were going into many of the hives, with a spot of white on this fur that looked at first sight almost like a drop of white paint. For several seasons we hunted in vain to see where they got this white spot. At one time it seemed to come from working on thistles; but we were obliged to give this up, for we found it most on bees one season when they did not notice the thistles at all. One swarm of beautiful Italians that filled their hive nicely in September had a white back on almost every bee. We lined them from the hive, and followed them. They went toward a large piece of wild woodland, and we scanned the tops of



Flower of the wild touch-me-not, showing the manner in which the bee gets the pollen on its back.

the trees in vain. Finally, over between the hills, beside a brook, we found acres of the wild touch-me-not (*Impatiens*), the same plant that we have often played with in childhood, because the queer little seed-pods will snap all to pieces when ripe if they are touched never so carefully. The nectar is secreted in the spur of the flower, shown at B.

The bee can reach this only by diving down into it almost out of sight; and when the coveted treasure is obtained it backs out with a ludicrous kicking and sprawling of its legs, and in so doing the down on its back is ruffled up the wrong way. Now, this would be pretty certain to get the pollen dusted all over it; but nature, to make sure, has planted a little tuft that bears the pollen just on the upper side of the entrance to the flower, at A; and as the bee struggles to get out, white pollen is brushed on its back most effectually, to be carried to the next flower, and so on.

Flowers pollinated by insects.—It is estimated that there have been described in the world up to the present time 132,584 different kinds of flowers. Kerner places the number of species pollinated by the wind at about 10,000; but this, undoubtedly, is an underestimate. But even if it is twice that number, there must be over 100,000 different species of flowers that are pollinated by insects. Insect flowers are usually bright-colored, often sweet-scented, and commonly yield nectar as well as pollen. The pollen, unlike the dry dusty pollen of wind flowers, is thickly beset with teeth, spines, knobs, pits, and grooves, which cause the grains to adhere together, and to the bodies of insects. Water is always hurtful to it, and there is an astonishing number of devices provided for its protection, the mere description of which would fill many pages. It is probable that insects first visited flowers for the sake of the pollen, and that the function of secreting nectar was developed later.

Any part of the flower may secrete nectar, as the bracts, sepals, petals, stamens, and pistils; but most frequently it is secreted near the base of the styles. Its quantity varies from an almost imperceptible layer to several drops or even a spoonful. In a tropical orchid coryanthes there collects in the hollow lip over an ounce avoirdupois.

Insects which are of importance as flower-visitors belong to four orders: the beetles (*Coleoptera*); the flies (*Diptera*); the moths and butterflies (*Lepidoptera*), and the bees, wasps, and their allies (*Hymenoptera*). Beetles appear to prefer pollen to nectar. Only a comparatively few of

them live on a floral diet. The flies are more common, but a great many of them are predaceous. All the butterflies and moths are adapted to sucking nectar, but many of the latter in the adult state never take any food at all. The bees, especially the honeybees, far surpass all other insects in importance as pollinators, for they are almost entirely dependent upon a floral diet, both for food for themselves and their offspring. The honeybee is on the wing very early in the spring, and continues to fly until late in the fall. Its great numbers, its general size and shape, the special construction of its tongue and legs, all together make it especially well adapted for collecting and carrying pollen.

Fly flowers are malodorous, as the carrion-flower, purple trillium, and skunk cabbage. Notwithstanding their nauseous odors honeybees visit certain kinds for pollen, as the skunk cabbage. Sometimes they serve as temporary prisons, holding the flies in captivity until they are completely dusted with pollen, as Indian turnip and Dutchman's-pipe. The nectar in many moth and butterfly flowers can not be reached by honeybees. Common butterfly flowers are the pinks, various primroses, lilies, and orchids, and some species of phlox. Among moth flowers are the evening primrose, the climbing honeysuckle of cultivation, some species of cacti, as the night-blooming cereus, the night-flowering catchfly, and the thorn-apple. The pollen may, however, be accessible to honeybees, as in the evening primrose. There are also many bumblebee flowers from which honeybees are commonly excluded. The best known is, of course, the red clover. The columbines are sometimes listed as honey plants; but honeybees are unable to obtain the nectar in the normal way, though they rob the nectaries freely after bumblebees have bitten holes in them. So, too, there are various species of aconite, larkspur, and sage, besides many other flowers, which do not yield nectar to honeybees.

In his magnificent work "Bees and Beekeeping," Vol. I., Mr. Cheshire gives a number of very interesting examples of flower pollination. It should, however, be remembered that most of these flowers, as the willow-herb, raspberry, apple, and kalmia, are visited by a great number of insects besides the domestic bee. While Cheshire appears to have drawn from Charles Darwin and Asa Gray, his illustrations showing how nature has sought to prevent self-pollination, etc., are so interesting and valuable, especially as they show the service performed by the bee, that we reproduce them here:

In Fig. 3 we have a cross-section of what is known as the common primrose (*Primula vulgaris*), that furnishes an example of one of the most remarkable cases of how Nature has schemed to bring about cross-fertilization. This is what is known as a dimorphic flower, that is to say, there are two forms of flowers on the same plant. At A the stigma of the female portion reaches up to the mouth of the flower tube. The anthers, or male portion, appear about half way down the flower tube as at *a*. At B we have just the reverse; the stigma stands about half way down the flower-tube while the anthers are clear at the top. The flower-tube itself is supposed to be

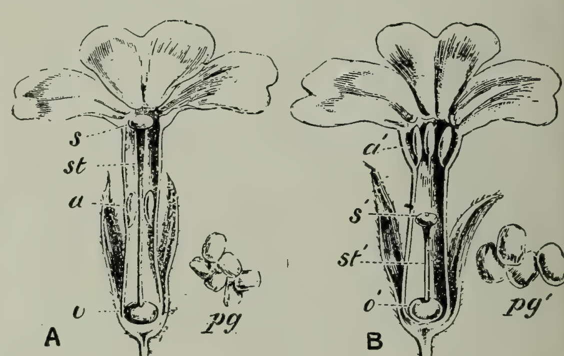


FIG. 3.—Cross sections of dimorphic flower (Primula vulgaris, common primrose), order *Primulaceae*.—A, long-styled flower; *s*, stigma; *st*, style; *a*, anther; *o*, ovary; *pg*, pollen grains, more magnified. B, short-styled form; *a'*, anther; *s'*, stigma; *st'*, style; *o'*, ovary; *pg'*, pollen grains, more magnified.—*From Cheshire.*

about the depth of the reach of a bee's tongue. A bee comes to A, reaches down at the point *o* for its nectar. The anthers half way up dust the tongue at a point about half way up its length. After the bee has secured its coveted sweet, it passes to the next flower, B, where the upper portion of the tongue and mouth becomes dusted with the pollen from the anthers, and the pollen dust that was secured from the other flower A will just reach the stigma in the flower B. The pollen dust that was received from the flower B will just reach the stigma in the flower A. There

is another significant and interesting fact, that the pollen granules of B are too large to be received in the stigma of B, but just right to go in the stigma of A. Thus we see how nature has cunningly devised a scheme of what is called dimorphic cross-pollination. In other words, she has so planned it that the pollen of the same flower can not fertilize its own stigma, hence we see the necessity of some insect of just about the right size, as the bee, of exactly over to B of a flower of the same species. Here the pollen is gone from the anthers, but the pistil has straightened out and the stigma is ripe to receive the pollen that the bee brings to it from the anthers of A of the other blossom of the same plant. It will be apparent in this particular case, unless insects, particularly the bee, carry the pollen from A to B, there will be no pollination of the plant, and the bloom will die without fruit.

FIG. 4.—*Epilobium angustifolium* (rosebay willow herb), order *Onagraceae*. —A, young flower; *s*, stigma turned back; *a*, anthers; *l*, lobe, or pod. B, older flower; *s*, stigma turned forward; *a*, anthers; *l*, lobe. C, spike of flowers. D, section of pollen grain; *e*, extine; *i*, intine; *ti*, thick intine; *f*, fovilla. E, growing point of pollen grain; *e*, *e*, extine; *i*, *i*, intine; *f*, fovilla; *pt*, pollen tube.—*Cheshire.*

the same tongue length that the bee has. Let us take another example.

In Fig. 4 we have a very pretty example of the fine honey-plant willow-herb; here the pollen of the anthers is mature before the stigma of the same flower. At A, Fig. 4, we notice that the stigma, or the style, rather, as at *s*, is turned backward away from the anthers at *a*. At this stage the pollen at the anthers is ripe. A bee comes along, dusts itself over the pollen in the act of securing nectar, and then passes

In Fig. 5 we have another case no less remarkable of a near relative of rhododendron and azaleas. The filaments bearing the anthers are curved downward, the anthers themselves being held in the little pockets of the corolla of the flower. Apparently they have no power of their own to release themselves. But a bee comes along, alights on the blossom, and as it reaches around for the nectar it jars these filaments loose, when they immediately fly upward, dusting the bees with pollen. This

pollen now on the bee may pollinate the stigma or pistil of B; but as the bee goes from flower to flower the pollen is mixed for it releases all the anthers, so that other visitations will continue the process of cross-pollination. We have familiar cases and reaches for the nectar as shown in cross-sectional drawing of B. The anthers and the stigma both touch the bee on the under side of the waist where there is a good deal of hair. The result is that powder is dusted on the waist of the bee; and

FIG. 5.—*Kalmia latifolia,* order *Ericaceae.*—A, flowering branch. B, expanded flower; *ap,* anther pocket. C, section of expanded flower; *ap, ap,* anther pockets; *s,* stigma; *a,* anther (free); *pg,* pollen grains in shower; *ca,* calyx. D, section of flower bud; *ap,* anther pocket. E, stamens, more enlarged; *a,* anther; *po,* pores; *pg,* pollen grains; *f,* filament.—*After Cheshire.*

of these anchored-down anthers in the rhododendrons, azaleas, and some of the swamp laurels. They are all honey-plants, but the honey is said to be poisonous.

In Fig. 6 we have a familiar blossom of the pea and bean, or technically known as it goes from one flower to another, it mingles the pollen and dusts it over the stigma. The general shape of the flower is such that the wind could hardly accomplish much in the way of cross-pollination, and apparently the bee has to exert some

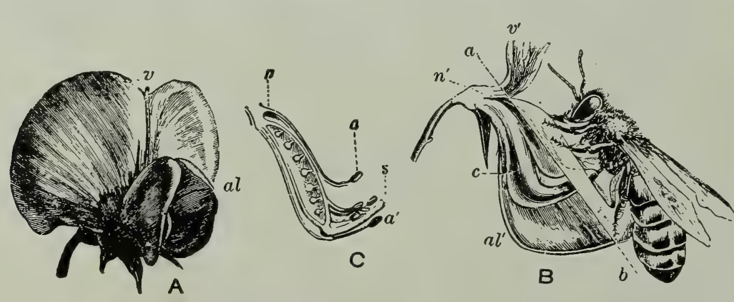


FIG. 6.—Papilionaceous blossoms, and their method of fertilization.—A, expanded pea blossom, order *Leguminosae*—*v,* vexillum; *al,* Alæ, with carina between. B, partial section of flower of vetch being fertilized by Cyprian bee (magnified twice), right ala removed below line *a, b*—*v',* vexillum; *n,* nectar gland; *al,* ala; *c,* carina containing the pistil, the stigma of which is striking the bee's breast. C, section of pistil, showing ovules (peas) in ovary—*n,* nectary; *a, a,* anthers; *s,* stigma.—*Cheshire.*

as papilionaceous flowers. At C we notice the embryo bean or pea pod. At *a* we see the anthers and *s* the stigma. This whole thing is covered by a sort of wings. The bee comes along, pries them apart, strength in forcing apart the wings of the corolla in order to get its coveted nectar.

In Fig. 7 we have the familiar raspberry blossom. This is a case of where there is very little color but considerable pollen

and nectar to attract the bees. The anthers and pistils separated from each other appear in large numbers on each blossom. The bee alights on the head and reaches down for the nectar. As it does so, it brushes against the large number of anthers and pistils. In doing so it mingles the pollen, pollenizing the flower with its own pollen and with the pollen from other plants.

In Fig. 8 we have the familiar example of the apple blossom. Note there are five stigmas and ten anthers. In many varieties of the apple, pear, and plum, the flowers are sterile to their own pollen; but, as Fletcher points out, they can be fertilized readily with pollen from flowers growing on another tree of the same species. We therefore see how very important it is to have insects, especially bees, to carry on this most important work of cross-pollination, without which there will be imperfect or no fruit at all. Many and many a time a lack of fruit during some particular season is ascribed to the fact that frosts kill the blossoms, when, as a matter of fact, the weather has been such that the honey-bees were unable to get out, and thus carry on the work of cross-pollination.

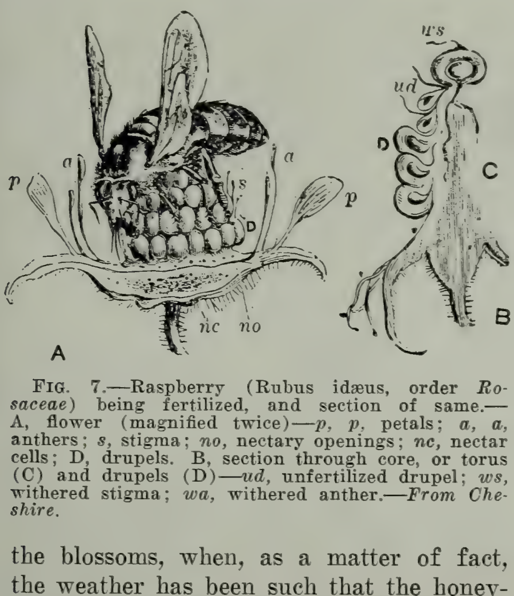


FIG. 7.—Raspberry (Rubus idæus, order *Rosaceae*) being fertilized, and section of same.—A, flower (magnified twice)—*p, p*, petals; *a, a*, anthers; *s*, stigma; *no*, nectary openings; *nc*, nectar cells; D, drupels. B, section through core, or torus (C) and drupels (D)—*ud*, unfertilized drupel; *ws*, withered stigma; *wa*, withered anther.—*From Cheshire.*

In Fig. 8 we have the case of an apple that was imperfectly fertilized. There is perfect seed and perfect fruit formation except on the side that has an indention. The statement has been made by some prominent growers of apples that it is such fruit as this that rarely hangs long enough to ripen. The first severe storm that comes along causes it to drop prematurely. One fruit-grower told us there were thousands and thousands of bushels of apples every year that are nothing more nor less than windfalls because of imperfect fertilization. This same fruit-grower went on to say that if the bees could get in their work properly, and the trees were sprayed before and after blossoming, the number of windfalls would be very considerably reduced.

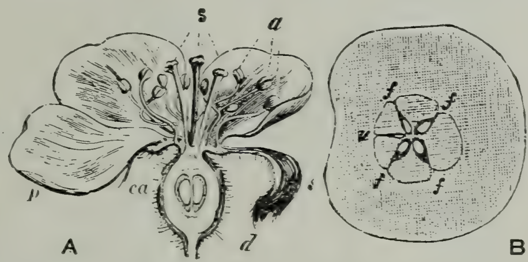


FIG. 8.—Apple (Pyrus malus, order *Rosaceae*) blossom, and section of fruit.—A, blossom (natural size)—*s*, stigmas; *a*, anthers; *p*, petal; *ca*, calyx; *s'*, sepal; *d*, dissepiment. B, section through partly developed fruit—*f, f*, fertilized carpels; *u*, unfertilized ditto.—*From Cheshire.*

In connection with this matter, the reader will be interested in referring to the subject of FRUIT-BLOSSOMS, elsewhere in this work, where limbs of trees and whole trees have been covered with netting while they were in bloom. The fact that almost no fruit develops under these nets shows that pollination brought about by the agency of the wind is insignificant as compared with that accomplished by insects, and that, of course, means the bees, for almost no other insects are flying in the early spring when fruit trees come into bloom.

In Fig. 9 we have a remarkable example of the flower of the salvias, among which we may mention the celebrated white mountain sage of California. Notice how Nature has made a convenient doorstep on which the bee may alight. But the more remarkable part of it all is, how the filament for the anthers is jointed. Turn to C, and it will be observed there is a spur or projection; namely, *ac*. The bee steps on the doorstep at *l*. Its head bunts against the projection, *ac*, causing the hinge-like movement to bend the anther, *a*, down upon its back, dusting it all over with pollen. The act can be seen a little more perfectly at D. Notice how the jointed anther is paint-

ing the back of the bee all over with pollen dust. In this particular flower, as at D, the stigma, for the time being, is sterile to the pollen of that flower, but the bee goes over to another specimen of the same species, as at B. It alights upon the door-step, and, with its back all covered with dust, the stigma projecting out from its little canopy above brushes over the back of the bee, picking up the pollen, thus securing the fertilizing element from some other flower of the same species. When we remember that large quantities of beautiful honey are secured from what is known as the white mountain sage, of California, we can realize the importance of this particular plant to the beekeeper. Without this cross-fertilization the plant would undoubtedly "run out" as we say.

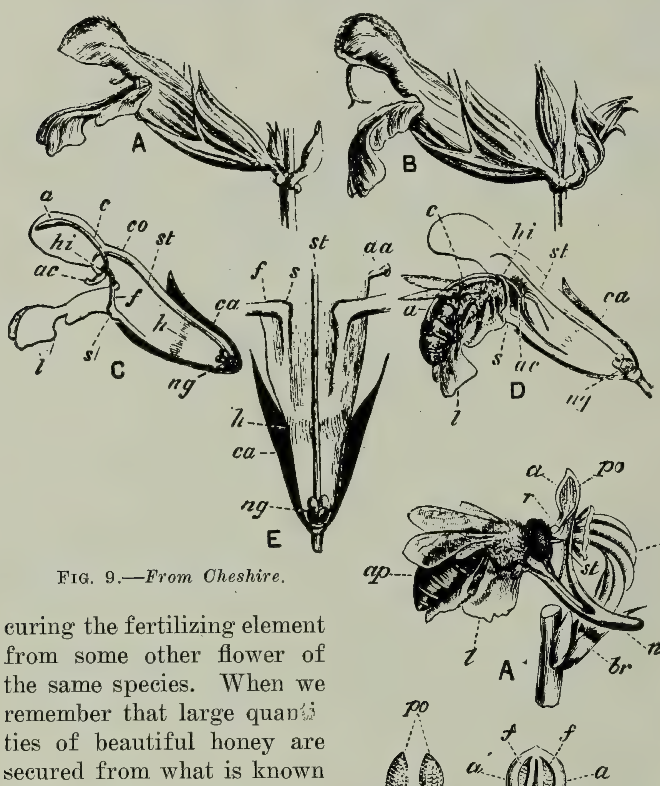


FIG. 9.—*From Cheshire.*

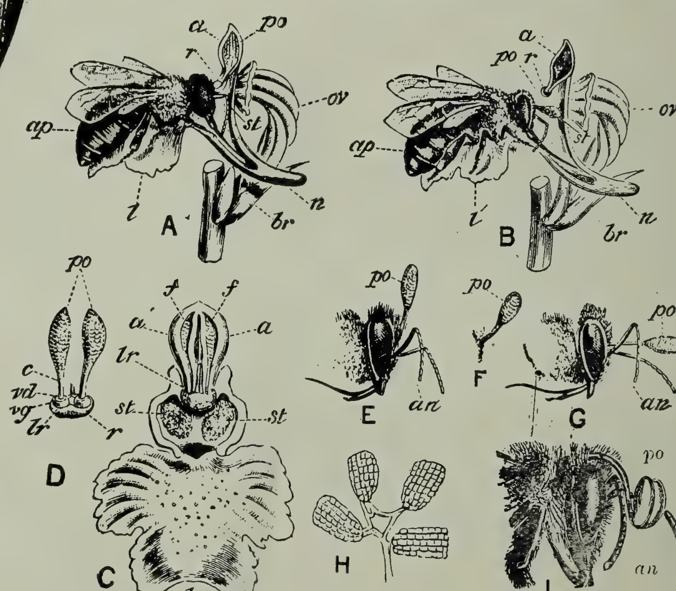


FIG. 10.—*From Cheshire.*

In Fig. 10 we have a still more remarkable case, as shown in the orchid. This flower is a little different in that the anther-sac has a sticky substance on the end, as shown at *r* in A. This pod adheres to the bee's forehead as shown at E and G. With this queer appendage containing its sac of pollen, the bee visits other blossoms, and, as seen at B, butts the pollen mass against the stigma. Chas. Darwin points out that this beautiful experiment can be accomplished with the point of a lead-pencil; but as it is not presumed that any foreign object should come in contact with the blossom except the insects, we can see how insect-polilnation is accomplished in this remarkable cross-way.

Throughout the animal and vegetable kingdom there seems to be a constant struggle for the perpetuation of their species, which is secured only by ripening *good* seeds. Notice how the weeds in our garden will struggle and fight, as it were, to get a foot-hold until they can get a crop of seeds ripened, and then notice the numerous ways they adopt to scatter this seed as widely as possible. If the plants were animated beings, we might almost call it tricks and sharp practice; some of the seeds have wings, and are blown about; others have hooks, and catch on our clothing, and on the fur of different animals, in the hope of being carried to some spot where they have a better place to germinate. Fruits and berries (when the seeds are fully ripened), instead of clothing themselves in the sober green of the foliage surrounding them, affect

scarlet red and other bright colors, and, sometimes, fancy stripes, which induce the birds to take them in preference to the fruit of other trees. Why do they want their fruits to be eaten by the birds, if it is their purpose to secure a place for their seed? Well, if you examine you will find that the seed is encased in a horny shell that is proof against the digestive organs of the bird, and these seeds and stones are, therefore, voided frequently or invariably while on the wing, in just the condition to take root in the soil wherever they may be cast. Bear this in mind while we go back a little to the bees and flowers.

We have suggested that the honey is placed in flowers to attract the bees. After a bee has found honey in one flower it will be very likely to examine others of a similar kind or appearance. If the flowers were all green, like the leaves of the plant, the insects would have much more trouble in hunting them up than they now do, because contrasting colors, such as the white and red of the clovers, make them conspicuous. If you look back to what we said about corn and ragweed you will see that the flowers of both are a plain green, for they have no need of bees to insure pollination.

It is easily proven that bees have a sort of telescopic vision that enables them to perceive objects at long distances. When a bee starts out in the morning it circles up aloft, then takes a view, and starts out for business. If one field of clover should be more conspicuous than the rest, it would probably give it the preference—at least, so far as to make an examination. If it has been at work on a profitable field the day before, it will, doubtless, strike for it again without any preamble. That bees look for honey, and hunt it out, we have proven to our full satisfaction; and we are well convinced that what is often called instinct, and allowed to drop there, is only profiting by experience and an excellent memory of past events, as human beings do. We say that bees instinctively go to the flowers for honey. We have watched them in the spring when the blossoms first open, and many a bee, very likely a young one that has never before seen a blossom, will examine the leaves, branches, and even rough wood, of the trunk of the tree, intently smelling and sniffing at every part, until it finds just where the coveted treasure is located. After it has dived deep into one blossom, and tasted the nectar, it knows pretty well where to look next time.

The touch-me-not has learned, by ages of experiment, to produce a bright orange flower, to secure honey in the spur, to place the pollen-bearing stamens at the point where the bee must rub against them in getting the honey, to construct those wonderful seedpods, which explode and scatter the seed far and wide, just that it may reproduce and multiply its species. We should judge it had succeeded pretty well in a waste piece of woodland near our home, for there are now acres of it as high as one's head, and it is quite a valuable acquisition to our apiary. As nearly as we can make out, the plant has much increased since the advent of the Italians, as might be expected. This is true of dandelions as well;* and the large, brilliant, showy blossoms that now line our roadsides and waste places, instead of unsightly weeds, should remind one how much an apiary of bees contributes to fulfill the words of sacred prophecy:

> The wilderness and the solitary place shall be glad for them; and the desert shall rejoice, and blossom as the rose.—*Isaiah* 35: 1.

Now, we can not positively affirm that flowers were given their gaudy colors through bees selecting the brightest and most conspicuous, thereby inducing such blossoms to bear seed in preference to those less gaudily attired, neither do we know that cherries became red because the birds selected those that showed a disposition to that color, year after year, for many centuries; nor can we prove that the bright plumage of male birds came about in the course of time, simply because the female encouraged the attentions of and showed a preference for those most handsome. We can only suggest that the actions of birds, bees, flowers, and fruits, seem to point that way. You all know how quickly we can get fancy-colored flowers, yellow queen-bees, or birds of almost any shade or color, by careful selection for several generations. Have not the bees so colored the flowers, and birds the berries, etc., although they did it all unconsciously?

It is significant that so many of the flowers have a form of construction and

* See DANDELION.

depth of flower tube that would indicate that it had adapted itself to the bee. While, of course, there are many exceptions, it appears that nature caters more to the bee than to any other insect. Just see how she makes a convenient doorstep or a flower tube of just the right size and shape, so that the bee can get the nectar which it has to offer. Cheshire has pointed out that so intimate and so perfect is the relation between the flowers and the honeybees that there would be no advantage in breeding larger bees or of changing their general structure, because to do so would necessitate changing practically the whole of the floral kingdom. While it undoubtedly would be an advantage to breed bees with longer tongues, that advantage would be manifest only in the case of red clover, and apparently old Dame Nature has designed that the common bumblebee shall perform the work here that can not fully be accomplished by the honeybee. It should be mentioned, however, that the honeybee does gather quite a little nectar from the red clover, and of course accomplishes to a considerable degree the work of pollination.

PRIORITY RIGHTS.—See Overstocking.

PROFITS IN BEES.—This question is a hard one to answer, as so much depends on the locality and the man, and the number of bees to the area.

On the average, perhaps, in the Northern States, in what is known as the rain-belt, one might expect to get anywhere from 25 to 50 lbs. of comb honey, and perhaps from 25 to 50 per cent more of extracted. There will be some seasons when he might secure as much as 100 lbs. or more on an average, and occasional seasons when there would be neither comb nor extracted, and the bees would require to be fed. Taking one year with another, a small beekeeper ought to average about 35 lbs. of comb honey, on a conservative estimate, providing he has reasonable skill and love for the business. The comb honey might net him, deducting the expense of selling, from 10 to 15 cents; the extracted, from 7 to 10. These figures do not include the labor of producing the honey nor the cost of the fixtures. The cost of the supplies, exclusive of sections and foundations, ought to be sufficient to cover 10 to 20 years if no increase is made. Suppose we put the comb honey at 35 lbs. as the average, and the price secured 14 cents net. The actual money he would get from the commission merchant or grocer might be about $5.00 per colony; but out of this he must deduct a certain amount for labor, and 10 per cent on the cost of supplies, to be on the safe side.

With only a few bees the labor would count for nothing, as the work could be performed by some member of the family or by the man of the house, who should, during his spare hours, do a little with bees, and work in his garden. In case of one, two, or three hundred, the labor item must be figured. The larger the number crowding the available territory the smaller the profit per colony. A rough estimate for an apiary in a locality not overstocked, not including the labor on the $5.00 actually received for honey sold, ought to leave a net profit of somewhere about $4.50. This would be on the basis that the locality did not require much feeding in the fall. If feeding was found to be necessary, 50 cents more might have to be deducted, making a net profit of $4.00. On this basis it will be seen that the profit in one season ought to pay for the hives and supers in one year, or come very close to it, leaving the investment good for ten or more years. If we figure it that way the ten per cent need not be added. For a professional man, or one who has other business, even these returns are not bad; for if he secured only enough for family use, the diversion or change to relieve the tired brain is worth something.

The question as to whether one should keep few or many bees will depend upon many conditions; but the principal one is the ability of the man. Many a person can handle a few chickens, and get good results; but when he runs the number up into the hundreds he meets with failure and disaster. Some of our friends have done remarkably well with a few colonies; but when they have attempted to double or treble the number they entered into a business proposition that proved to be too much for them.

Many years ago a neighbor of ours cleared a thousand dollars from one acre

of onions. It made him wild. He bought ten more acres of the same kind of onion land, going into debt for it, and expected to clear the following year $10,000. When he managed the one acre he did all the work himself; but when he worked the ten acres he had to hire help. The help was incompetent, or did not understand. Onions fell in price; and at the final round-up that year he had a great stock of poor onions without a buyer. They rotted. He became discouraged, and lost all he had.

A good many, on account of a lack of experience or perhaps business ability, not understanding their own limitations and those of their localities, will plunge into beekeeping too deeply and meet with disaster. There are, undoubtedly, some people who can keep more bees by scattering them in outyards; and if they have the requisite training and business ability they can make more money. But where we find one person who can manage 500 colonies or more successfully, there will be dozens who can not go beyond the 200 or 300 mark. The same rule applies to any business.

Now let us look at the other side of the question—the side of expansion. Perhaps here is a beekeeper who has 300 colonies. During the busy season he is comfortably busy. But during six months in the year his time is not very profitably employed—a distinct loss; for it will take him only a short time, comparatively, to get his supers ready for the next season, nail his hives, repaint them, or do other preliminary work that can easily be done indoors, and yet his interest, or his rent and his living expenses, are going right on. Suppose, for example, that this beekeeper has 600 colonies, or 1000; that he has good business ability; that he has plenty of bee-range. Suppose he scatters this number in 15 different yards, none further than 15 miles from his home, and a good part of them not over four or five miles away. In the busy season he will, of course, have to employ help. If he has the right kind of executive ability he will see that that help is profitably employed. When the rush of work is over he will look after the marketing of the crop, put the bees into winter quarters, perhaps doing the work himself with the occasional help of one man and a team. In cold weather he can devote *all* of his time profitably in preparing for the next season. Now, while he is operating 1000 colonies it costs him no more to live; the same horse and wagon that will carry him to two or three hundred will carry him to the other seven or eight hundred. If he is running for extracted honey, the same extractor, uncapping-knives, and smokers can be used at each yard. He is thus enabled to put his invested capital where it will be earning money for him *all the time* in the busy season instead of eating up interest part of the time. We will suppose that some of his swarms get away from him; we will also suppose that some of the work is not done as well as when he had only 300 colonies; but he has increased his honey crop by three times, possibly, and has increased his actual operating expenses only to the extent of the help that he has to pay for, extra hives, and sugar to feed. A couple of men and a boy three months in the year—the man at $2.00 and a boy at $1.00 per day—would make his expense $450. To this we will add $50 for extra team hire. The cost of the extra 700 colonies with hives and supers divided by ten (assuming that they would last ten years) would be $250 more, or $750. But we must add $250 more for sugar for feeding and $250 for sections, foundation, and shipping-cases, making $1250 as the total added expense for the 700 extra colonies. Say he is producing comb honey, and that he can average 35 lbs. per colony. If this nets him 14 cts. he would get from 300 colonies $1500. If he has 1000 colonies his gross income will be $5000 by adding only $1250 to his general expenses.

This is a supposable and a possible case. The most that we would show is that the operating and overhead expenses will not be proportionately increased if the number of colonies be doubled or trebled—all on the assumption, of course, that our beekeeping friend has the necessary skill and business ability.

PROPOLIS.—This is the gum or varnish that bees collect for coating over the inside of their hives, filling cracks and crevices, cementing loose pieces of the hive together, and for making things fast and close generally. It collects, in time, on old hives and combs, so as to add very materially to their weight. It is not generally

gathered in any great quantity until at the close of the season, when it seems to be collected in response to a kind of instinct that bids them prepare for cold weather. We see them almost every day, during a dearth of honey, collecting propolis from old hives, old quilts, and pieces of refuse wax, when we are so wasteful and untidy as to leave any such scattered about. That the principal part of it comes from some particular plant or class of plants, or tree, we are pretty well satisfied, for almost the same aromatic resinous flavor is noticeable, no matter what the locality or season of the year. Bees gather propolis with their mandibles, and pack and carry it precisely as they do pollen.* It is never packed in the cells, however, but applied at once to the place wanted. It is often mixed with wax to strengthen their combs, and is applied to the cells as a varnish, for the same purpose. In the absence of a natural supply, the bees frequently resort to various substances, such as paints, varnishes, resins, pitch, and the like; and the superstition, popular in some sections, that bees follow their owner to the grave, after his death, probably obtained credence from seeing the bees at work on the varnish of the coffin. To save the bees the trouble of waxing up the crevices in their hives, it has been suggested that a mixture of melted wax and resin be poured into the hive and made to flow along the cracks and corners. This may do very well, although we fancy the bees can do this better and cheaper than we can. Our principal trouble has been to get rid of the surplus propolis, and we would much rather hear of some invention to keep it out of the way than to add more. It has been said that grease, lime, chalk, or talc applied to the parts will prevent bees from depositing propolis, for the reason that they can not make it stick.

HOW TO KEEP PROPOLIS FROM SURPLUS HONEY.

Of course, the readiest means is to remove all sections just as soon as a single one is capped over; and as but little propolis is gathered during a strong yield of honey, but little will be found on the honey unless it is left until the yield has ceased. The bees not only cover all the woodwork of the sections if left on too long, but they also varnish over the whole surface of the white capping, almost spoiling the looks and sale of the honey.

It is next to impossible to keep propolis from the sections entirely. Bees will deposit at least some in the interstices between the sections. As Nature abhors a vacuum, so do the bees dislike a crack or crevice. The nearer we can get surplus arrangements so as to leave but few crevices or places of contact accessible to bees, the less propolis will be deposited. Some surplus arrangements are made so as to produce compression upon the sections, thus reducing the space formed by contact with sections to a minimum. Some prefer to have the outside of the sections covered entire. This can be accomplished either with the wide frames or with surplus arrangements having the top and bottom to correspond with the outside of the sections. For removing propolis from sections, see Comb Honey.

HOW TO KEEP PROPOLIS FROM STICKING TO THE FINGERS.

At certain times of the year, notably in the fall when propolis is very abundant and sticky, after the honey-flow is over and the bees have nothing else to do, they will sometimes gather a great deal of resinous matter which they chink into every available place, sometimes smearing over the brood-frames. When these latter are handled the fingers gather up a great deal of the sticky stuff, making the work unpleasant, not to say annoying. At such times one may wear gloves; but as many do not like them, the trouble can be overcome to a great extent by dipping the fingers in vaseline, lime, or talcum powder.

HOW TO REMOVE PROPOLIS FROM THE FINGERS.

A variety of substances have been suggested. Alcohol is perhaps the neatest, but is rather expensive; benzine or gasoline or common lye for soap-making answers nearly as well, and is cheap; soap will answer if a little lard be rubbed on the hands first but will have little effect on it otherwise. A friend down south says he has a pair of light cotton gloves which he slips on when

* Propolis is packed while the bee is standing, whereas pollen is packed while she is flying.—A. C. M.

handling his waxy frames, and his hands are left clean whenever he is obliged to stop work. For removing it from glass, etc., alcohol is perhaps best. When we have much glass soiled, it can often be cleaned most expeditiously by boiling it in a kettle of water with a quantity of wood ashes, or, better, lye. Right here we can not do better than to reprint an article by Miss Wilson, Dr. Miller's assistant, from *Gleanings in Bee Culture.*

When I cleaned the T tins with concentrated lye, I felt pretty sure that hives, supers, separators, etc., could be cleaned in the same way, but was so busy I could not take time just then to experiment, hence concluded to say nothing about it till I could find time to test the matter. This morning, May 5th, being the first opportunity I have had, I concluded to experiment a little.

I put on my wash-boiler with water and lye, then went to the shop and selected the most badly propolized supers and separators that I could find as fit subjects on which to experiment. I dropped a few separators into the boiler while the water was yet cold, to see what effect it would have on them. I could not see that it affected them in the least until the water almost reached the boiling-point, when the propolis disappeared.

What I was most afraid of was that the separators while wet would cling so closely together that the lye would not reach every part, and hence they would not all be perfectly clean. I was glad to find these few did not bother at all, but came out perfectly clean. I stirred them with the poker while boiling, although I don't know that it was necessary, as I tried another lot without stirring, and they came out just as clean. I next tied up a bundle of 59 separators, that being the number I had handy. Of course, they were tied loosely. I dropped them in, having a strong cord tied around the middle of the bundle to lift them out by. I let them boil two or three minutes, and took them out; 32 of them were perfectly clean. The rest, in the center of the bundle, still had some propolis left on, and were treated to a second dose.

Taking a very large quantity of the separators at one time, there might be more trouble than I think about getting them clean, but I don't believe there would be if the water were kept hot enough, and enough of the lye used. I don't think any harm would come from having it unnecessarily strong.

I next tried dipping the T supers. My boiler was large enough to clean only half a super at a time, so I had to dip in one half, reverse it, and dip the other half. Had I been able to dip one all at once, I think I could have cleaned one a minute. And they are beautifully cleaned. I don't know of any other way they could be cleaned so nicely—quite as clean, I think, as when new. We scraped all our supers before the lye was thought of; and while they are much improved by the scraping they are not nearly as nice as when cleaned with lye, while the scraping is harder work.

I did not have any thing large enough to dip a hive into, but of course a hive would clean as readily as a super. With convenient apparatus to work with, a large number of such articles as separators could be cleaned at a time with no very great amount of labor. It is such a comfort to have every thing clean! Wood separators are so cheap that we have always thought it did not pay to clean them. I rather think we shall conclude that it does pay, after this, providing we can get them satisfactorily dried in good shape.*

DO THE BEES NEED PROPOLIS?

Much discussion has arisen in regard to the habit bees have of making all openings tight with propolis. Theory says, if allowed to follow their bent, or instinct, they will smother themselves to death. Practice says they do, at least at times, so prevent the escape of moisture that their home gets very damp and wet, filled with icicles, etc., so that they suffer; or, at least, such is the case in the hives we have provided for them. Who is right—the bees or the enlightened beekeeper? The greater part of the fault lies in the hive we have given them. The enameled cloth which we formerly used for covering bees is as impervious to air and moisture as the propolis they collect with so much pains and trouble. If the outside of this is allowed to get frosty, it will, most assuredly, condense the breath of the bees on the inside; and if the outside is but thinly protected from the weather, icicles will certainly form on the inside, and freeze the bees all fast in a lump. Now we would have no fear at all in having the bees wax up every thing as tight as they wished, if we could have their winter apartment made so small that they completely filled it—filled it so full, indeed, as to be crowded out at the entrance, unless in very cold weather—and have the entire outside protected with some non-conductor that would enable the bees to keep the inner walls warm at all times. We think then we should have no dampness. With chaff packing and chaff cushions, we have succeeded so well that we are perfectly willing the little fellows shall fix up just as snug for winter as their instinct prompts them to do.

VALUE OF PROPOLIS.

The gum has been used to some extent in medicine; also in the preparation of certain leather polishes. It is claimed that propolis for this purpose possesses a property that renders it superior to any of the pitches or resins.

* It was found necessary to pile up the separators evenly, and put a weight on them, else they would curl badly in drying.—C. C. M.

Q

QUEEN-REARING.—Every honey-producer should know how to raise his own queens. There are times when it is better to buy them, and other times when it is certainly cheaper to rear them. Other things being equal, a queen that has never been compelled to go through the mails, shut up in a mail-sack, to be bumped about in this way and that for a period of two or three days or perhaps that many weeks, ought to live longer and give better results than one that is compelled to undergo such treatment. It very often happens that a queen which has been doing excellent service for a year or so, when introduced after being sent through the mails, dies within a few days, for the very probable reason that the journey was too much for her.* It would seem, then, that every beekeeper should himself rear the majority of the queens that he uses, buying only just enough to renew his stock or to introduce new strains. But before proceeding further with this subject, the reader would do well to read QUEENS (found in its alphabetical order), as this furnishes the groundwork of the subject we shall now discuss.

CONDITIONS FAVORABLE AND UNFAVORABLE FOR REARING QUEENS.

When a colony from some cause or other becomes queenless, the bees will set about rearing another.

In nature, the best queens are those that are reared either during the swarming-time or when the bees are about to supersede an old queen soon to fail. At such times we see large beautiful queen-cells, reminding one of big peanuts, projecting from the side of the comb. The larvæ in such cells are lavishly fed with royal jelly; and when the queens finally hatch they are usually large and vigorous.

We said there is one class of cells that bees rear when they are about to supersede an old queen. When a queen is two or three years old she begins to show signs of failing. The bees recognize the fact that their own mother will soon die, or at least need help from a daughter, and very leisurely proceed to construct a number of cells, all of which are supplied with larvæ, and fed in the same lavish way as those reared under the swarming impulse.

But we can never determine in advance when the bees will rear supersedure cells, and it may be true that the queen about to be superseded is not desirable stock from which to rear. In this case such cells should not be utilized. For a like reason, also, it may be that cells reared under the swarming impulse should be rejected; because it is certainly penny wise and pound foolish to rear queens from any thing but the very best select stock. But all swarming-cells from good queens should be reserved by placing them in West queen-cell protectors; then hunt up queens two or three years old, pinch their heads off, and replace them with one of these cells in each colony. But perhaps you have good queens even two or three years old. Perhaps; but the majority of our honey-producers think it profitable to replace all queens three years old, while a good many make it a practice to requeen all colonies having queens two years and over, and of late years there is a slight tendency on the part of a few to requeen every year.

While these swarming-cells produce the very best queens, yet it may not be convenient to requeen during the swarming

* A queen taken in the full tide of her laying from among thousands of bees where she constantly obtains all the food she needs, and shut in with a dozen or two bees which may or may not be able to supply her with one square meal, is bound to suffer. Egg development does not stop at once, and the system must be nourished to make up for loss, but it can not be under the circumstances. Furthermore the sudden checking of egg development is bound to act as a shock to the system.—A. C. M.

season, which in some localities may be a very bad season to do so, owing to the interruption that it makes in the regular production of honey; for it is well known that a good many colonies will not do as well in honey-gathering when they are queenless as when they have a good queen in the hive. But such cells can then be given to nuclei, for they ought not to be wasted.

Among the several systems of rearing queens, the one put out by Mr. Doolittle* a few years ago forms the basis of some of the best now in vogue, is very simple, requiring no special tools more than one can improvise for himself. Thoroughly understanding this, the reader will be in position to carry out the more advanced ideas put forth by Samuel Simmins, E. L. Pratt, Henry Alley, and others.

Drone, queen, and worker.

THE DOOLITTLE METHOD OF REARING QUEENS.

While Mr. Doolittle's system is slightly artificial yet he endeavors to make his methods conform as nearly as possible to Nature's ways. The first thing of prime importance in the rearing of queens is to bring about conditions that will approach, as nearly as possible, those that are present during the swarming season at a time when the bees supply the cell-cups lavishly with royal food. One of the first requisites, then, for cell-building is strong powerful colonies; second, a light honey flow, or a condition almost analogous, viz., stimulative feeding if the honey is not then coming in. Queens reared during a dearth of honey, or in nuclei, are apt to be small, and the cells from which they come look small and inferior. The mothers that do the best work are those that are large, and capable of laying anywhere from 2000 to 3000 eggs per day.* A queen that is incapable of this should not be retained. For instance, a colony with a good queen might earn for its owner in a good season $5.00 in clean cash. In the same season the same colony (or, perhaps, to speak more exactly, the

* Mr. Doolittle was not the originator of the whole system he used.

* It is not necessarily the *large* queens which do the best work. Also 2000 to 3000 is hardly the maximum of "best" queens. A Langstroth comb has approximately 6000 cells, and good queens will not infrequently fill all of one and part of another in twenty-four hours. This summer I saw fourteen colonies, each with two 12-frame chambers for the queen; and in several which I inspected, the queens had the whole 24 frames filled with brood in various stages. This figures out like this: 24 times 6000 equals 144,000 cells of brood. Divide this by 21, the time from egg to mature bee, and the result is 6857 for a day. Allowing for some pollen (and there was not much in those 24 combs) the figure 6000 could not have been far from what those queens were doing.—A. C. M.

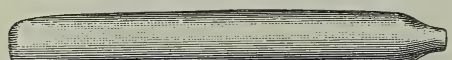
same hive of bees), with a poorer queen, would bring in less than half that amount. A queen that can lay 2000 or 3000 eggs a day at the *right time of the year,* so that there will be a large force of bees ready to begin on the honey when it does come, is the kind of queen that we need to rear.

The old way of raising queens was to make a colony or a nucleus queenless; wait for the bees to build their own cells, then distribute them to colonies made queenless beforehand. This plan is very slow and wasteful, and, worst of all, results in the rearing of inferior queens. Mr. Doolittle takes advantage of Nature's ways to such an extent that he is enabled to rear a large number of queens from some selected breeder, in that he makes it possible to increase the number of cells ordinarily built; for the prime requisite in queen-rearing is cells—plenty of them—that will rear good strong healthy queens.

The first step in queen-rearing is to provide queen-cups. Many times, when an apiarist is going through his yard he can cut out embryo cell-cups, such as bees make. These can be utilized at some future time for the purpose of grafting. But such cells, after they are gathered, are exceedingly frail, irregular in shape, will not bear much handling, and most of the time one can not find enough.

HOW TO MAKE DOOLITTLE CELL-CUPS.

Mr. Doolittle was among the first who conceived the idea of making artificial cell cups that should not only be regular in form but of such construction as to stand any reasonable amount of handling. Contrary to what one might expect, such cells are just as readily accepted by the bees as those they make in the good old-fashioned way; and, what is of considerable importance, they can be made in any quantity by one of ordinary intelligence.



Mr. Doolittle takes a wooden rake-tooth, and whittles and sandpapers the point so that it is the size and shape of the bottom of the queen-cell (see illustration). Two or three other sticks are then fashioned of the same shape and pattern. Preparatory to forming the cells Mr. Doolittle has a little pan of beeswax, kept hot by means of a lamp; also a cup of water. Seating himself before a table he is now ready for work. Taking one of these cell-forming sticks he dips it into water, after which he plunges it about 9-16 of an inch into the melted wax. He then lifts it up and twirls it at an angle (waxed end lower) in his fingers. When cool he dips it again, but not quite so deep, and twirls it as before. He proceeds thus until the cup is dipped seven or eight times, but each time dipping it less deep, within 1-32 inch of the previous dipping. The main thing is to secure a cup having a *thick heavy bottom,* but which will have a thin and delicate knife edge at the open top, or at that point where the bees are supposed to assume work. After the last dipping is cooled, a slight pressure of the thumb loosens the cell-cup slightly. It is then dipped once more, and before cooling it is attached to a comb or stick designed to receive it.

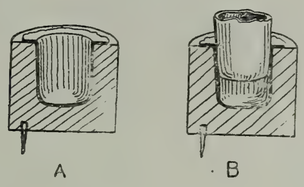
GRAFTING CELLS.

The next operation is to insert a small particle of royal jelly in every queen-cell so made. The amount in each should be about equivalent in bulk to a double-B shot, says Mr. Doolittle. But we have found that a much less quantity will answer. Out of an ordinary queen-cell well supplied with royal jelly we get enough to supply 20 cups. If we took a quantity equal in bulk to a BB shot we would have to rob two or three cells to supply that many. This royal jelly should come from some queen-cell nearly ready to seal, as that will contain the most. It should be stirred to bring all to about the same consistency, after which it may be dipped out of the cells by means of a stick whittled like an ordinary ear-spoon, or a toothpick bent to that shape.

The next operation is to take a frame of young larvæ just hatched from the eggs of our best breeding queen. Each little grub should be picked up with the aforesaid ear-spoon, and gently laid on the royal food previously prepared in one of the cell cups. A larva should be given to every one of the cell cups in this manner, and when all are supplied they are to be put into the cell-building colony, which will be explained further on.

REARING QUEENS IN LARGE NUMBERS.

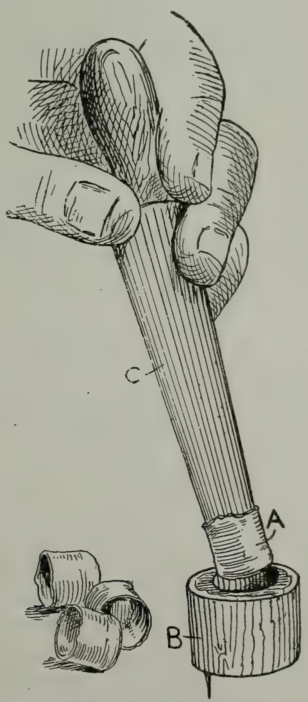
Thus far we have considered the old original Doolittle system of rearing queens; and where one desires only a few for his own use he may find this method more convenient than the one we will now de-



Cross-section of wooden cell-holder; cell cup partially pushed into place.

scribe. But if he has any number to rear he should by all means carry out the following plan. The method of preparing the colonies for cell-building will be the same.

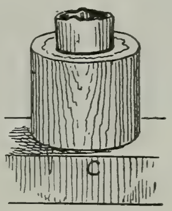
Instead of dipping the cells one by one with a stick, or dipping several sticks at once, compressed cell cups are made on a plan originally devised by E. L. Pratt.



Manner of inserting cell cups in cell-holders.

With a suitable die, cells more nearly perfect than can possibly be dipped by the slow process already described are punched out at the rate of 2000 an hour. These are furnished by dealers, and, generally speaking, it would be better for readers of this work to buy cell cups than to attempt to make them by the dipping process.

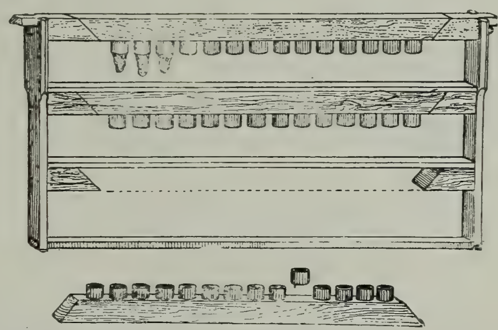
To facilitate general handling, the modified Doolittle system calls for wooden cell-holders, which may, under certain circumstances, be used as direct cell cups.



Cell-holder with cell in place.

These are nothing more nor less than cylindrical pieces of wood, $\frac{3}{4}$ inch in diameter, $\frac{5}{8}$ inch long. A suitable drill bores out one end of the right size to receive one of the compressed cell cups. These wooden cell-holders can likewise be purchased by the thousand.

The compressed cups are forced into the hole in the cell-holders by means of a little plunger-stick. When enough of them have been prepared, and secured to a cell-bar

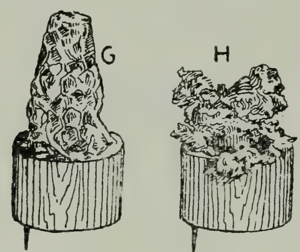


Hoffman frame with removable bars for cell-holders.

by means of nail-points forced into the soft wood, we are ready for the grafting, which process is much the same as that already described in the Doolittle method, except that a much smaller quantity of royal jelly is used, and special tools are provided for the purpose, these latter being obtained of the dealers. Sufficient royal jelly is gathered up from a series of cells, and the same is stirred with a special jelly-spoon. A spoonful is then held in the left hand, while the right hand uses the grafting tool to take a speck of the royal jelly, about

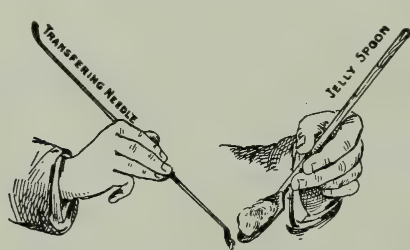
the size of the head of a pin. This is then placed in the bottom of one of the compressed cups. Other cups are treated in the same way until the whole series of cells is provisioned.

If one should run short of compressed cups he can, with a keen-edged knife, cut



G, fully completed cell from holder; H, partially built cell torn away to get at the royal jelly. Supplying cells with royal jelly.

off the old cell, from which the queen has hatched, even with the wood, and then with the plunger-stick ream out the hole in the cell-holder. This hole can be grafted in the manner already explained; but it will be found preferable to use the compressed cups, as better results will thus be secured. The next operation is to take a comb of very young larvæ, just hatched, from a

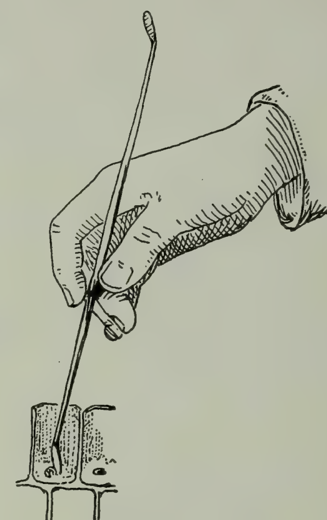


Supply cells with royal jelly.

breeding queen. In an atmosphere not cooler than 75 or 80 degrees (the warmer the better) a young larva is scooped or lifted up out of a worker-cell with the flattened end of the grafting tool, and deposited in the royal jelly of one of the compressed cups, and so on until all the cups are grafted. And just here it is proper to remark that this royal jelly serves a double purpose. It affords a downy bed, so to speak, in which to lay the larva, and at the same time provides food until the bees can give it a fresh supply. Despite the claim that royal jelly is not necessary we get more cells accepted with it.

GETTING CELLS ACCEPTED AND BUILT OUT.

The average beginner will probably succeed best by giving grafted cells to a queenless strong colony. In about two days after making it queenless a bar of 15 cells (not more) inserted in a frame of brood may be given. If no honey is coming in from natural sources, the colony



Lifting a larva out of a worker-cell.

should be fed in a manner to be explained. When conditions are right, nearly every cell, if not *every* one of them, will be accepted. By "accepted" is meant those artificial cups on which the bees have begun work, and to which they have added their own royal jelly. After being accepted they are given to the upper story of a strong colony to be completed with an excluder between the two stories.

The question might be raised right here, "Why not make these upper stories *start* as well as *complete* the cells?" For the simple reason that they will not *start* work of this sort except under the most favorable conditions; and the average queen-breeder has decided it does not pay to try to make the attempt. We therefore have one colony to start the cells and another to complete them *after* they are accepted in another colony.

To return: After the first batch of fifteen grafted cups have been accepted and removed, another batch of fifteen may be

given, and so on the process can be repeated. But such cell-starting colonies should not be kept for such purpose more than three weeks, on account of the danger of laying workers. See LAYING WORKERS.

In eight days after giving the first batch of grafted cells, it will be necessary to go over the combs very carefully and destroy any *natural* cells of their own; for if these are left in the hive the bees will do no work on the second batch of cells. In the mean time a virgin would hatch and trouble would happen. Even after the first batch of natural cells are cut out, it is advisable to go over the combs again in eight days, because a colony like this may steal an egg or two from some other colony.

Another excellent cell-building colony outside of the swarming season is one having a queen which it is trying to supersede. One or more such colonies will be found in a large apiary, but as a general rule the queen is hardly good enough to use as a breeder. Having found our colony, we begin giving it daily feeds at once, this being a requisite for the best results in cell-building with any colony, either with a queen or without one. This supersedure cell-building colony will not only draw out and complete one set of cups but several sets in succession; but it is best not to give any one such colony more than a dozen or a dozen and a half prepared cups at a time. Allow it to finish up one batch, and then, if necessary, give it another.

To one of our supersedure colonies, as we call them, we gave one batch of Doolittle cups after another until they had completed over 300 fine cells; but we were careful to take away each lot before any could hatch, of course, for a young virgin would very soon make havoc of the other cells unhatched, and besides would get the colony out of the notion of trying to supersede the old queen.

Just how far supersedure bees will continue to build out batches of cell cups one after another, we are not able to say; but if they are fed half a pint of syrup daily they appear to be willing to keep up the work indefinitely, in the hope that they will some day be able to rear a virgin that will supplant the old queen that appears to be failing.

There is still another plan used by queen-breeders to get cells accepted or started in a more wholesale way; and that is, make up a forced-cell-starting colony. This is done by making a strong colony queenless and broodless excepting the few combs of honey it is allowed to have. The combs are taken out one by one, and shaken in front of the entrance. When combs are cleaned of bees it will be very easy to see any eggs. Combs containing honey are set back in the hive, and with them two division-board feeders. One is placed on each side and half filled with syrup; and an hour or two after the bees have been made queenless they will set up a roar; for without any brood or any possibility of producing it, they are in dire distress, and in just the right condition, psychologically, to rush upon grafted cups that may be given them. The nurse bees are already supplied with pap; and with no young brood of any kind to feed they have royal jelly in any quantity to give the cups. A colony in this condition may be given 100 cells on two frames, which are placed in the center of the colony in places previously left vacant. If every thing has been done right, nearly every one of the cells should be accepted; but don't attempt to make such a colony start a second batch of cells. When the cells are accepted they are taken out and placed in an upper story of a cell-building (or, rather, cell-completing) colony now to be described.

While queenless bees will complete any cells given them, yet such cells will not be as good as those built under the swarming or supersedure impulse. We therefore make up a two-story colony with an excluder between the stories. The lower hive contains the queen, but the brood is lifted into the upper story. The queen and bees below will begin rearing more brood. If no honey-flow is on, it is important to feed, because otherwise these cell-builders will tear down the work so nicely started in the other hive.

Under FEEDING we described the Boardman feeder. As the bees will take the feed out of this a little too rapidly we solder up or otherwise close all the holes except the outside row, and two or three holes in the center. At any rate, we aim

to leave just enough holes so the bees will empty the feeder in 20 or 24 hours. Another feed must be given the next day. If a day is skipped in feeding, the colony begins to feel that the honey-flow has stopped, and apparently comes to the conclusion that there will be no necessity for continuing the work of cell-building. When feeding stops, it will often destroy work nicely under way. It is, therefore, *vitally important to feed every day.*

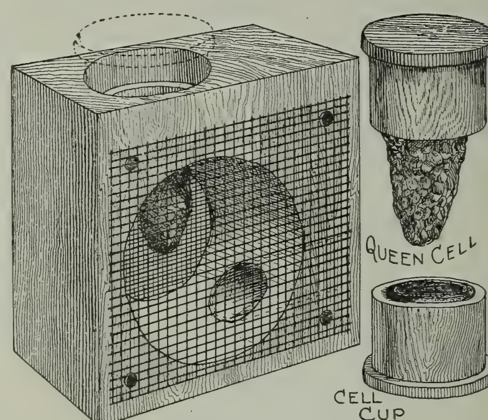
Such cell-builders will take care of and build out about fifteen cells at a time. When the first batch is sealed, another batch of accepted cells may be given, and so on the process may be continued throughout the season—provided, however, the colony is kept up to the swarming-pitch by *continuous* feeding.

In about twenty days brood is again lifted from the lower to the upper hive and the combs from which brood has hatched above is put below. Brood must be kept above to keep cell-building going on.

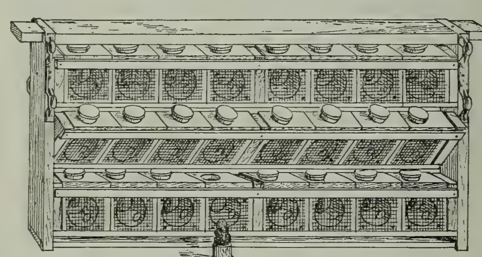
NURSERY CAGES.

The illustration shows a batch of cells taken from one of these cell-builders. In large queen-breeding establishments there will be a dozen or more cell-building colonies kept constantly on the job; but the ordinary beekeeper who desires a few queens of his own will not need to keep more than one such colony going more than a few days.

The cells are now ready to be placed in nursery cages, one of which is shown herewith. This, it will be seen, is practically a modified Alley cage. A surplus of cells often occurs in queen-rearing—that is to say, a lack of queenless nuclei or colonies to take them. One should arrange to have more than he will probably be able to use, to provide for bad weather, when cells will be destroyed or young hatched virgins will be missing. At such a time, if one has extra cells or virgins that he can take out of a nursery, he can quickly make good the loss



Nursery cage for cells and virgins.



A nursery frame.

Fully completed queen-cells built on wooden cell cups here described.

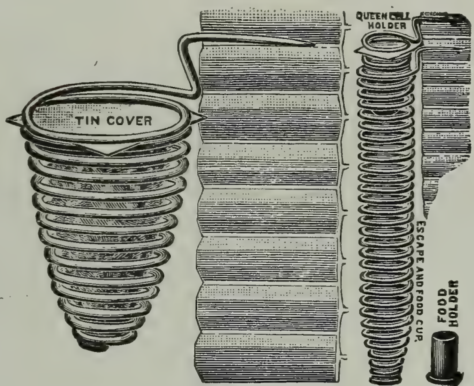
The nursery cage here shown has a large opening at the top to receive the wooden cell cup; the small hole in the lower right-hand corner is filled with queen-cage candy to supply the young miss after she hatches. Twenty-four of these cages, supplied with cells that are capped over, can be put in a nursery-frame having holders which may be tilted on an angle so that any one cage can be easily removed from a holder without disturbing the rest. There are three of these holders in each frame, pivoted at both ends as shown. When the nursery-frame has been filled with cages, each containing a capped cell, it should be put down in the center of a strong colony.

While various artificial-heat incubators using kerosene-lamps have been devised, experience has shown a majority of breeders that nothing is quite so good as a strong cluster of bees. What is still more, when the young virgins hatch, some of the bees will be inclined to feed them through the wire cloth, providing a stimulus that they can not receive from the queen candy in the cage. After the virgins have hatched they should be transferred to Miller cages, and introduced *as soon after hatching as possible.* The younger the virgin, the more successful will be her introduction. After she becomes four or five days old, even if she be accepted by the bees they are likely to mistreat her so that her usefulness thereafter will be greatly impaired. While it is possible to introduce these virgins to full-sized colonies it is not practicable. It is practicable to introduce them to baby nuclei if not too old. See Introducing Virgin Queens, under head of Introducing.

DUAL PLAN OF INTRODUCING VIRGIN QUEENS.

It sometimes happens that a breeder will have a great surplus of cells, or more virgins than he has queenless nuclei or colonies. In such cases we have found it practicable to introduce two queens at a time. First a virgin, the younger the better, is introduced in a Miller cage to a baby nucleus. After two or three days she should be released; in about four days more, being seven days from the time of caging the first queen, another virgin may be caged among the same bees; but the candy of the second cage through which the bees liberate the queen must be covered with a little strip of tin or the bees will liberate her prematurely. In two days more the first virgin will be mated, and within two or three days will begin to lay if the weather is favorable. Then she is removed and sent out to fill an order; the strip of tin covering the candy of the second cage is opened to let the bees release virgin No. 2, and, having already acquired the colony odor, she will usually be accepted in less than a day's time. In about seven days from the time she was caged, a third queen, if there is still a surplus of virgins, may be put into the nucleus while No. 2 is taking her mating-flight, and so the progress may continue so long as there is a surplus of virgins.

This is really high-pressure queen-rearing, and should be practiced only when there is a surplus of virgins, or when there are rush orders for cheap queens. We say cheap queens, because the queens introduced on the dual plan may or may not be the equal of those introduced in the regular



West queen-cell protector.

way where a single queen is introduced at a time and is confined in a cage not more than a couple of days. If the virgin is very young, just hatched, and the nucleus has been queenless a couple of days, she can be let loose quietly over the top of the frames without any caging; but care should be taken not to allow her to touch the hands, for the scent of the human body sometimes causes the bees to attack and kill her.

Some queen-breeders prefer to give ripe queen-cells to their nuclei direct, claiming that too many of the virgins that they introduce anwhere from one to four and five days old are lost. It is doubtless true, the average beginner will succeed better with

cells than with virgins; but if cells be given make sure that the nuclei are strong in bees. In some cases it will be necessary to use West queen-cell protectors to keep the bees from gnawing holes into them.

The long spiral cage on previous page is designed to slip under the queen-cell protector, and when the young queen hatches out she will pass into the long cage, where she can be held secure from bees or other virgins in the colony that might kill her.

BABY NUCLEI, AND HOW TO MATE QUEENS IN LARGE NUMBERS.

After securing a large lot of nice cells in the cages already shown and described, it is next in order for us to consider the mating box or hive. As already explained, one can use one or two full-sized Langstroth frames and put them in a three-frame box or hive, or in a full-sized hive, by using a division-board to reduce the space; or, better still, take an eight-frame hive-body and divide it off into three equal compartments by inserting two tight-fitting division-boards lengthwise that will reach clear up to the cover, and close the holes of the hive rabbets. Each compartment will then be just wide enough to take two full-sized Langstroth frames. The under side of this hive should have a wire-cloth bottom, for reasons to be given later. The two outside compartments should each have an entrance, one on each side of the hive along the center. The center compartment should have one at the rear of the hive-body. These entrances should be made with a half-inch bit, and have a cleat nailed just below, forming a narrow door-step.

When complete we shall have an ordinary eight-frame hive-body with wire-cloth bottom, having three two-frame divisions with an entrance on each side and one in the rear. Each of these compartments is to receive two frames of brood and bees, after which it is set over a strong colony of bees. The heat passing from the bees beneath will keep the three clusters above perfectly warm, no matter if the weather should be a little cool. Queens or cells may be given to each one of these nuclei, as already explained, and queens will be mated from the upper story in the regular way. Where the climate is a little uncertain and the season short, there is nothing better than this divided-off upper story.

But where one desires to secure the largest number of queens possible from a given force of bees, a twin-mating nucleus on a much smaller scale is to be preferred.

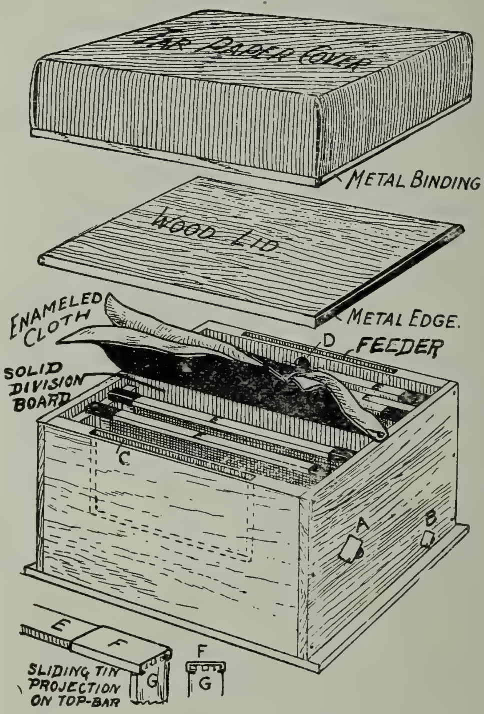
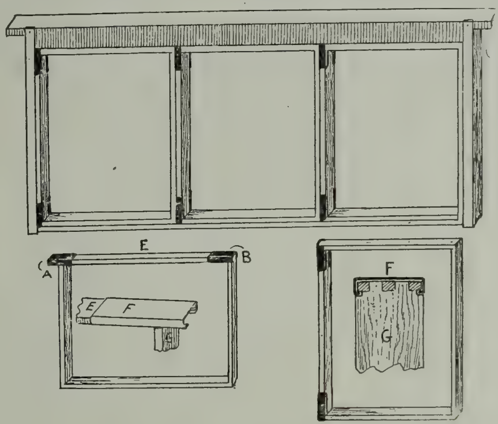


Fig. 1.—Twin mating-box.

The illustration shows one the authors use. It is just right so that one of its compartments on either side will take two frames of such size that three of them will just fit the inside of a regular Langstroth frame, the division being made on vertical lines. The baby hive itself is on the same general principle as a full-sized one, having rabbets at the ends to support the frame projections. A division-board through the center lengthwise, ⅛ inch thick, divides the hive off into two bee-tight compartments. Tacked to this board is a square of enamel-cloth which, when spread, covers both sides. In order that the little frames may hang in the rabbets and yet at the same time be fitted inside the full-sized Langstroth frame, projections or supports are made of metal, and so constructed that they can slide forward to form a projection, or be shoved back out of the way.

Early in the season these little frames are filled with full sheets of foundation;

or, better, from a lot of old defective combs can be cut the good portions and fitted in these third-sized nucleus-frames. When filled with comb or foundation three of them are inserted in a common Langstroth frame, which may be put down in



Twin-nuclei frame.

the center of a good colony. Where preferred a colony may be supplied exclusively with these three-in-one frames. When filled they can be given bees and all to the baby hives by being taken out of the large frame, and the metal projections shoved forward or outward, as shown at F and A. They are now ready to hang in the nucleus-box; but before this is done each division of the twin box should be supplied with about half a pint of bees. While the bees may be taken from the same yard in which the mating-boxes are to be stationed, it is strongly advised to procure them from an outyard; or, if one does not have one, to purchase three or four colonies of black or hybrid bees from some farmer. All their drones must first be captured with perforated zinc.

FORMING BABY NUCLEI.

We take a regular eight-frame hive-body that has a wire-cloth screen bottom and a removable wire-cloth screen top. We then go to some one of the other yards and shake into this box some ten or twelve pounds of bees. These may come from four or five colonies, but generally from a dozen or more hives, so that we do not pull

FIG. 2.—Scooping the bees with a small dipper into baby nuclei.

too heavily upon a few. This box of bees is then taken to the queen-rearing yard, where the nuclei are to be formed. Four of the twin baby hives are first placed upon a little light stand, each filled with empty combs ready to receive the bees, entrances closed, and ventilators opened. The hive-body containing the shaken bees is then placed conveniently near. They are wet down with a spray, then given a jar so as to get the bees down in a mass in the bottom. With a little tin dipper we scoop up approximately four ounces of bees, making anywhere from a thousand to twelve hundred individuals. As the bees have been previously wet down they can not fly very readily, and can therefore be scooped up *a la* Pratt and dumped in one of the compartments as shown in Fig. 2. An attendant stands ready with a number of virgin queens. He removes one of the frames of one compartment, and, while the apiarist is scooping up a dipperful or two of bees and dumping them in the space made vacant by the removal of the frame, he drops in a virgin queen that had previously been dipped in honey or syrup. He now puts in the removed frame and folds back the enamel cloth. The operation is repeated in the other compartment of the box, and so on the process is continued until all of the twin mating-boxes are filled with bees and virgin queens. The baby hives are then set to one side for about 48 hours, when they are placed on their permanent stands for the summer. Their entrances are opened at night. The next morning, as the bees come out they will mark their location and begin housekeeping with their baby queen.

After the baby nuclei are in full operation we give ripe queen-cells in place of virgins given at first. The two frames are spread a little apart when the cell is placed in position and secured.

At the time of forming these baby nuclei, a thick syrup of about 2½ parts of sugar to one of water is poured into the feeder compartment at one side. At other times, if it is a little cool it is given at night, hot, when it will all be taken up before morning. This feeding may be required off and on during the season. In some years the baby nuclei will gather enough to supply their own needs. At other times they will require a little help.

These little twin nuclei serve only the purpose of mating. No cells are reared in them, and the comparatively small number of bees in each compartment makes it easy to find a laying queen or virgin if present. If in doubt as to whether the nucleus has a virgin, another cell is given; and even should the virgin come back from her flight she will take care of that cell by gnawing a hole in its side and killing its occupant. Should she be lost in one of those flights the cell will provide another virgin, which will come on in due course of time. It is better to have a surplus of cells than to lose time.

These baby nuclei have been carefully tested in one of our yards, and have given us good results; but one needs to remember a few things in handling them or he may become disgusted with the whole plan.

1. If the force becomes a little weak, give a frame of hatching brood, but not eggs or larvæ; or if this can not be had, after the last queen is taken out dump in a few more bees from a strong colony of the main yard. While some of these will go back, many will remain.

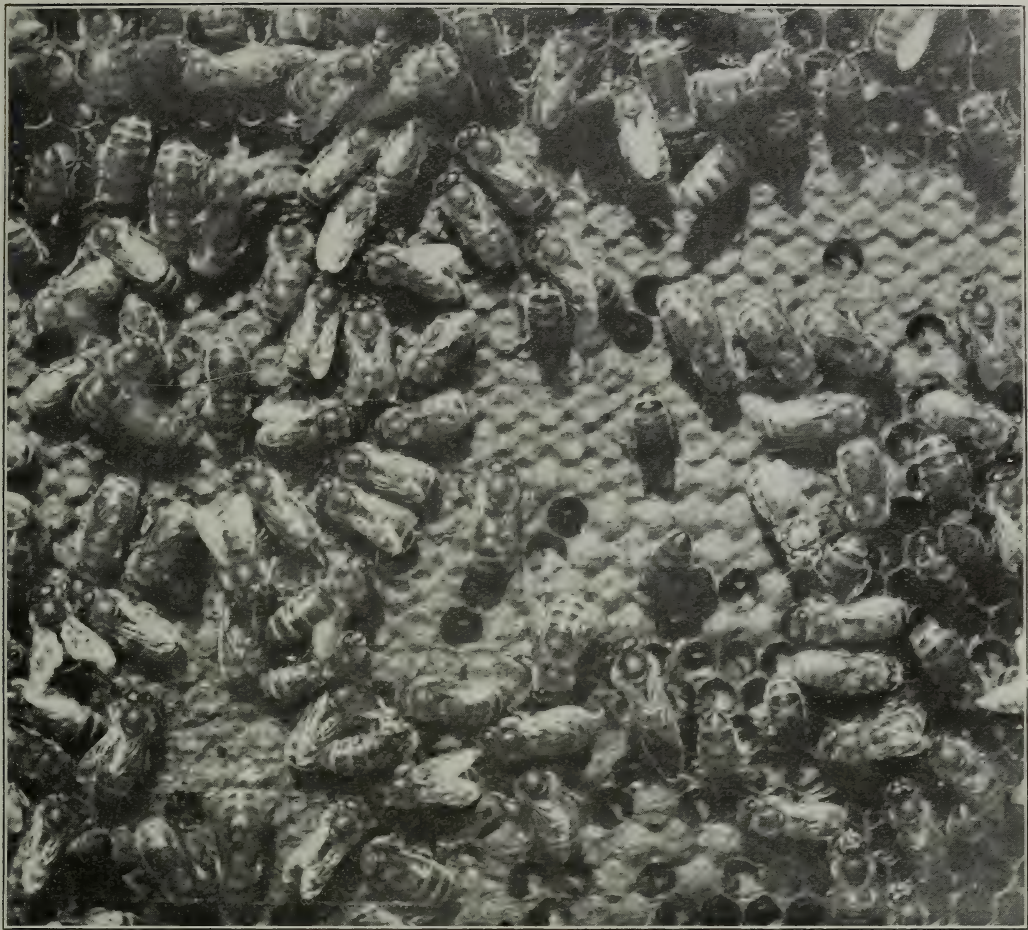
2. After the young queens begin to lay they should be taken out almost immediately, otherwise they will fill the two small combs with eggs and lead off a little swarm if there is a honey-flow on. If not convenient to take the queen out at once, the perforated zinc slide should be shoved around to shut her in.

3. It is preferable to make up these little nuclei with bees from some outyard.

4. Do not allow one side of the nucleus box to become empty of bees. The combined heat of the two clusters brings about a better state of contentment. Where there is only one compartment of bees in a mating-box we find they can not do as well as when there are two.

QUEENS.—The most important personage in the hive is the queen, or mother-bee. She is called the mother-bee because she is, in reality, the mother of all the bees in the hive.

When we deprive a colony of their queen, the bees set to work and raise another so long as they have any worker-larvæ in the hive from which to do it. This is the rule, but there are some exceptions —so few, however, that it is safe to assume



Find the queen.

that a queen of some kind is present in the hive whenever they refuse to start queen-cells on larvæ of a proper age.

IMPERFECTLY DEVELOPED QUEENS.

Some queens are small,* unusually dark in color, and sometimes become fertilized. They lay eggs for a little while (from a week to several months), but never prove profitable. Sometimes they will not lay at all, but remain in a colony all through the season, neither doing any good nor permitting any other queen to be either introduced or reared. A wingless queen, or one with bad wings, will produce the same result. The remedy is to hunt them out and remove them. Where they are so nearly like a worker-bee as to make it hard to distinguish them, they can often be detected by the peculiar behavior of the bees toward them. See woodcut below. In the fall, after the queen has ceased laying, she will usually look small and insig-

The queen and her retinue.

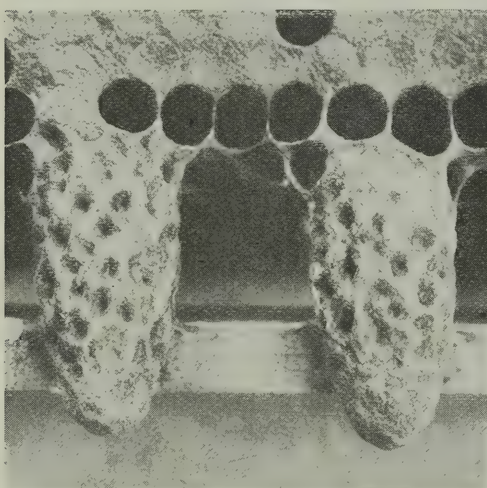
nificant even though she be an extra good one. But if it is during the laying season, when all fertile queens are laying, and the queen looks small, she should be removed,

* Small queens are not necessarily inferior. One of the most marvelous egg-producers I ever saw was a "bantam" from Golden stock. She could run through perforated zinc and back again before a worker could get started through.—A. C. M.

and another put in her place. It doesn't pay to keep any thing but the very best stock. The loss in honey would pay for several good queens.

HOW A WORKER-EGG IS MADE TO PRODUCE A QUEEN.

This is a question often asked, and it is one that puzzles us about as much to answer as any question a visitor can ask. We



Natural queen-cells somewhat enlarged.

can not promise to tell you all about it, but we will tell you all we know about it. First get a frame of eggs, as we did in studying BEES, but we will vary the experiment by putting it into a colony having no queen. The tiny eggs will hatch into larvæ as before; but about as soon as they begin to hatch, if we look carefully we shall find some of the cells supplied with a greater profusion of milky food than others. Later these cells will begin to be enlarged, and soon at the expense of the adjoining ones. These are queen-cells, and they are something like the cup of an acorn in shape, and usually occupy about the space of three ordinary cells. In the cut, you will see cells in different stages of growth.

There are some queer things about queen-cells, as you will notice. After the cell is sealed, the bees put a great excess of wax on it, make a long tapering point, and corrugate the sides something like a thimble, as shown at C, and in the enlarged view that is shown above. This corrugation, or roughness, when closely examined, will be seen to be honey-comb on a very small scale. Bees, like other "folks," sometimes make mistakes; for they do not seem to know any better than to use a drone-larva for rearing a queen, if such happens to be present, and they have nothing better.

Now, it is very handy to be able to tell nearly when any queen-cells you may happen to find unexpectedly will be likely to hatch; and the bees are very accommodating in this respect also; for, about the day before the queen hatches, or may be two days, they go and tear down this long peak of wax on the tip of the cell, leaving only a thin covering. We don't know why unless they are anxious to get a peep at their new mother. It has been said they do it that she may be better able to pierce the capping; but sometimes they omit the proceeding entirely, and we have not been able to see that she has any difficulty in cutting the cap off. If the cell is built on new comb, or on a sheet of foundation, and be held up before a strong light at about the fifteenth day, or a little later, you will see the queen moving about in the cell. Afterward, by listening carefully, you can hear her gnawing her way out. Pretty soon the points of her sharp and powerful mandibles will be seen protruding, as she bites out a narrow line. Since she turns her

Queen-cells, after Cheshire.

body in a circle while doing this, she cuts out a circle so true that it often looks as if marked by a pair of compasses. Now observe that the substance of which the cell is made is tough and leathery, and, therefore, before she gets clear around her circle, the piece springs out in response to her pushing, and opens just about as the

lid of a coffee-pot would if a kitten should happen to be inside crowding against the lid. We have often seen them push the door open and look out, with as much apparent curiosity as a child exhibits when it first creeps to the door on a summer morning; often, after taking this look, they will back down into their cradles, and stay some time. This is especially the case when other queens are hatching, and there is a strife as to who shall be sovereign.

We will now consider the strange substance royal jelly.

The milky food before described, which is given to the young larvæ, and which is supposed to be a mixture of pollen and honey partially digested, is very similar, if not identical, in composition with the royal jelly. Bees are not the only examples in the animal kingdom where the food is taken into the stomach by the parent, and, after partial digestion, regurgitated for the use of the offspring. Pigeons feed their young precisely in this way until they are able to digest their food for themselves. It has been stated that bees use a coarser food for the worker larvæ, after they are a few days old, and also for the drone larvæ during the whole of their larval state. What we mean by "coarser food" is, a food not so perfectly digested; in fact, drones are said to be fed on a mixture of pollen and honey, in a state nearly natural. This may be so, but we have no means of proving it to our satisfaction. It has also been said, that queens receive the very finest, most perfectly digested, and concentrated food that they can prepare. This we can readily believe, for the royal jelly has a very rich taste—something between cream, quince jelly, and honey—with a slightly tart and a rank, strong, milky flavor that is quite sickening if much be taken. See Royal Jelly, under the heading Anatomy of Bees.

WHAT DOES THE QUEEN DO WHILE SEALED UP?

Candidly, we do not know very much about it, although we have opened cells at every stage after they were sealed until they were ready to hatch. One day after being sealed they are simply ordinary larvæ, although rather larger than worker larvæ of the same age; after two or three days, a head begins gradually to be "mapped out," if that is the proper expression, and, later, some legs are seen folded up; last of all, a pair of delicate wings come from somewhere, we hardly know where. See Bee Behavior. Two days before hatching we have taken them out of the cell, and had them mature into perfect queens, by simply keeping them in a warm place. We have also taken them out of the cell before they were mature, held the white, still, corpse-like form in the hand while we admired it as long as we chose, then put it back, waxed up the cell by warming a bit of wax in the fingers, and had it hatch out three days after, as nice a queen as any. Mr. Langstroth mentions having seen the whole operation by placing a thin glass tube, open at both ends, into the cell, so

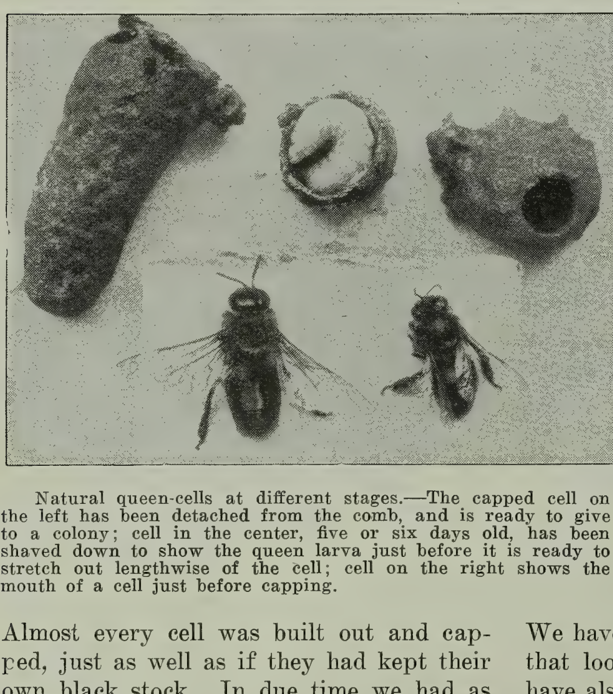
Natural-built queen-cells, life size.—Photographed by W. Z. Hutchinson.

as to have it inclose the queen, the bees being allowed to cap it as usual. This experiment was first made by Huber. With several such glass queen-cells, we presume the whole operation could be watched from beginning to end. See Observatory Hive.

DAVIS' TRANSPOSITION PROCESS.

In the month of August, 1874, after we had discovered how to send larvæ for queen-rearing safely by mail short dis-

tances, our friend, Mr. J. L. Davis, of Delhi, Ingham Co., Mich., wrote that he would get a large number of queens from the piece we sent him, for he was going to remove the larvæ from the combs and place them in queen-cells already started in his hives—of course, removing the original larvæ first. We caught the idea at once, and went to some hives of hybrids that had persisted in tearing down all the cells given them, and building others from their own brood, and removed the larvæ from all the cells, substituting larvæ from the imported queen in its stead. We used a quill toothpick for making the transposition.



Natural queen-cells at different stages.—The capped cell on the left has been detached from the comb, and is ready to give to a colony; cell in the center, five or six days old, has been shaved down to show the queen larva just before it is ready to stretch out lengthwise of the cell; cell on the right shows the mouth of a cell just before capping.

Almost every cell was built out and capped, just as well as if they had kept their own black stock. In due time we had as nice a lot of fine yellow queens as we ever reared. We have practiced this method almost every year since, and now call it "grafting." See QUEEN-REARING.

WHAT BECOMES OF THE QUEEN AFTER SHE LEAVES THE CELL?

We can tell you, by personal observation, pretty nearly what a queen does after she pushes open that hinged door, which you will find illustrated at C, second column, page 464. She generally begins by poking her head into the cells until she finds one containing unsealed honey, from which she takes a sup that, at least, indicates she likes that kind of provision.

After she has had her supper she begins to crawl about, partly to enjoy using the long strong legs God has given her, and partly because she knows that it is her allotted task to tear down the remaining queen-cells, if such there are. If other queens have hatched before her, it is one of her first and foremost duties to look them up, and either reign supreme or die in the attempt. When all other cells have been removed, as they usually are where queens are wanted for other purposes, she has nothing to do but to promenade over the premises, monarch of all she surveys. If she ever sits down to take a rest, or takes a rest in any other position, during the first week of her life, we have never been able to discover it.*

But suppose she does find another cell—what then? Well, she sometimes runs around awhile; sometimes the bees tear it down, and sometimes she tears it down herself, with the same strong mandibles that she used to cut her way out of the cell at first. She usually makes the opening in the side of the cell, as shown at E in the woodcut on page 464.

Now, it is said that the queen immediately stings her helpless immature sister to make a sure thing of her destruction, but of this we are not certain, for we never have caught her in the act. We have seen spots in the side of the queen that looked as if she had been stung; we have also rescued cells and put them into a wire-cage nursery after they had been torn open, and had them mature into nice queens. As these immature queens are very soft, the workers will soon pick them out of the cell, piece by piece, and we have sometimes placed them in the nursery and had them mature, minus a wing or leg, or whatever portion the mischievous worker had pulled away. We judge from many such observations that the queen generally tears a hole in the cell, or bites into it in such a way that the workers take hold of it, and tear it all down, much in the way they do any mutilated or broken piece of

* *Rarely.* Workers do that so far as I have observed.—A. C. M.

comb. When queen-cells have been cut out, all the larvæ that are in any way injured are at once thrown out, and none but the perfect cells preserved. Bees never fuss with cripples, nor try to nurse up a bee that is wounded or maimed. They have just the same feeling for their fellows that a locomotive might be expected to have for a man whom it had run over. They battle against any thing that threatens the extinction of the colony, it is true; but we have never been able to discover any signs of their caring for one of their number, or even having compassion on their helpless brood when it is wounded and suffering. If a hole is made in a queen-cell by the queen or by anybody, they are almost sure to tear it down and throw it away. When a queen hatches, the remaining cells are very soon town down, as a general thing, but there are many exceptions. Where two queens hatch out at about the same time they also generally attempt to kill each other; but we have never heard of both being killed. This probably results from the fact that they can sting their rivals only in one certain way; and the one that, by strength or accident, gets the lucky position in the combat is sure to come off victorious. This explains how a very inferior virgin queen, that has entered the hive by accident, may sometimes supplant an old laying queen. Two queens, when thus thrown together, generally fight very soon, but this does not always happen. Several cases are on record where they have lived in peace and harmony for months, even when hatched at about the same time, and it is quite common to find a young queen helping her mother in the egg-laying duties of the hive, especially when the mother is two or three years old. If the season is good, and the hive populous, they may divide up their forces, and we have AFTER-SWARMING, which see.

Sometimes the queen will pay no attention to the remaining cells, but will let them hatch out, and then their "little differences" are adjusted afterward, either by swarming or by the usual "hand-to-hand" conflict "until death." We once looked for a queen, and, not finding her, concluded she was lost. Another cell was inserted, and in due time hatched out. We were much surprised to find this new queen laying when only one day old; but a little further looking revealed two, both on the same comb. Many losses in introducing queens have resulted from two queens being in the hive, the owner being sure his hive was queenless—because he had removed one. See INTRODUCING.

QUEENS' VOICES.

Queens have two kinds of voices, or calls, either one of which they may emit on certain occasions. It is almost impossible, on the printed page, to describe these sounds. One of them is a sort of z-e-e-p, z-e-e-p, zeep, zeep. Some call it piping, others teeting. Whatever it is, it consists of a prolonged tone, or, as we might say, a long zeep followed by several much shorter, each tone shorter than the preceding one.* This piping is made when the queen is out of the cell, either virgin or laying, but usually by a young one. The older ones are generally too dignified, or too something, to give forth any such loud squealing; but they will squeal, and lustily, too, sometimes, when the bees ball them and grab them by the legs and wings. They shout just as we would when surrounded by enemies on every side, and in mere fright give a yell of alarm.

The other note that queen-bees are known to give forth is what is called *quahking,* for that more nearly describes the actual sound than any other combination of letters we can put together. If we mistake not, it is emitted only by a young queen in the cell, before she is hatched, and is made in answer to the piping or zeep, zeep, of one of the virgins that has already hatched, and is trying perhaps to proclaim aloud her sovereignty. The quahk will be heard, then, only when there are queen-cells in the hive. At other times the note will be a series of long z-e-e-p, z-e-e-p, followed by shorter tones, as explained.

While a young queen is being introduced she frequently utters a note of alarm, a zeep, zeep, etc. The bees are almost always stirred by these notes of the queen, and they will often turn and run after her and cling around her like a ball, when they would have paid no attention to her had she not uttered this well-known note. When you have once heard it you will recognize it ever afterward. Queens, when placed

* Suggestive of the crying of a lost chicken.—A. C. M.

near together in cages, will often call and answer each other, in tones that we have supposed might be challenges to mortal combat.

Some queens received one summer from W. P. Henderson, of Murfreesboro, Tenn., called so loudly when placed on our table, that they could be heard clear across a long room. One voice would be on a high, shrill key and another a deep bass, while others were intermediate. On watching closely a tremulous movement of the wings was noticed while the queen was uttering the note, and one might infer from this that the sound is produced by the wings, but this is probably not the case. Some one, we think, reported having heard a queen squeal, both of whose wings had been entirely clipped off. That these sounds from the queen have the power of controlling certain movements of the bees we are well aware, but we do not know just how nor to what extent this influence works.

VIRGIN QUEENS.

The newly hatched queen is termed a virgin simply to distinguish her from queens that have been fertilized by the drone and are laying. Virgin queens, when first hatched, are sometimes nearly as large as a fertile queen, but they gradually decrease in size, until when three or four days old they often look so small and insignificant that a novice is disgusted with their appearance, and, if he is hasty, pronounces them good for nothing. For the first week of their lives they crawl about much as an ordinary young worker does, and it is often very difficult, if not almost impossible, to find them, unless an amount of time is taken that is more than a busy apiarist can well afford to spare. We advise not to look for them, but to insert a frame having some unsealed larvæ just hatched from the egg; then if no cells are started, you can decide the queen is there without looking further. This plan answers a threefold purpose: It tells at a glance whether the queen is in the hive all right or not; for the very moment she is lost they will start more queen-cells on it; keep them from going out with the queen in case the queen is lost by any accident on her wedding-flight, which is frequently the case; and, lastly, it serves as a sort of nucleus to hold the bees together and to keep them from going out with the queen on her wedding-trip, which they are much disposed to do, if in a small nucleus containing no brood.* Unsealed brood in a hive is a great safeguard against accidents of all sorts, and we have often started a young queen to laying by simply giving the bees some eggs and unsealed brood. Whether it caused her to rouse up and take her wedding-flight, or whether she had taken it, but was for some reason idle, we can not say; but this we know, that young queens that do not lay at two weeks of age will often commence, when eggs and larvæ are given to their colonies. It may be that the sight of eggs and larvæ suggests to them the next step in affairs, or it may induce the workers to feed them, as they do a laying queen, an unusual quantity of food.

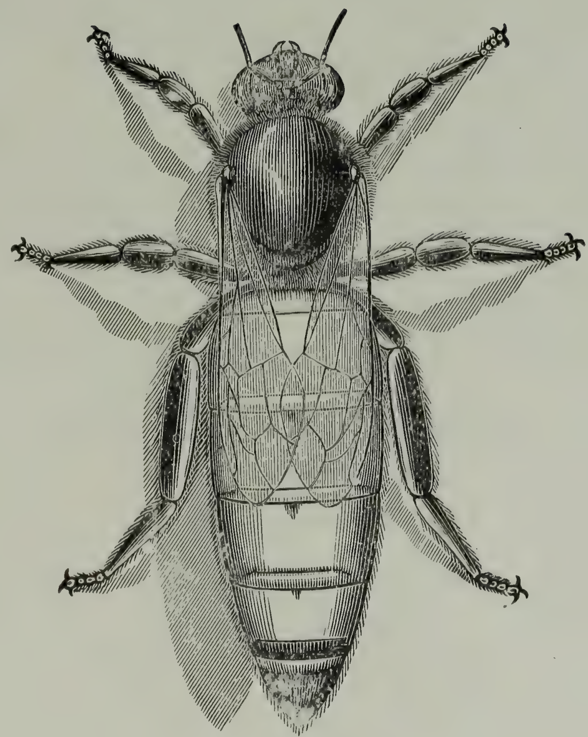
AGE AT WHICH VIRGIN QUEENS TAKE THEIR WEDDING-FLIGHT.

Our books seem to disagree considerably on this point, and we are afraid many of the book-makers find it easier to copy from the sayings of others than to try practical experiments. Some go so far as to say that the queen goes out to meet the drones the day after leaving the cell. Others fix the wedding-flight from two to ten days after birth. It is quite likely that some difference arises from the fact that queens often stay in the cell a day or two after they are strong enough to leave it.† Sometimes a queen will be found walking about the combs when she is so young as to be almost white; we have often seen beginners rejoice at their beautiful yellow queens, saying that they were yellow all over, without a bit of black on them; but when looked at again, they would be found to be as dark as the generality of queens. At other times when they come out of the cell they will look, both in color and size, as if they might be three or four days old. The queens in our apiary generally begin to crawl about the entrance of the hive, possibly looking out now and then, when 5 or 6 days old. The next day, supposing of course we have fine weather, they will generally go out and try their wings a little. These flights are usually taken in the

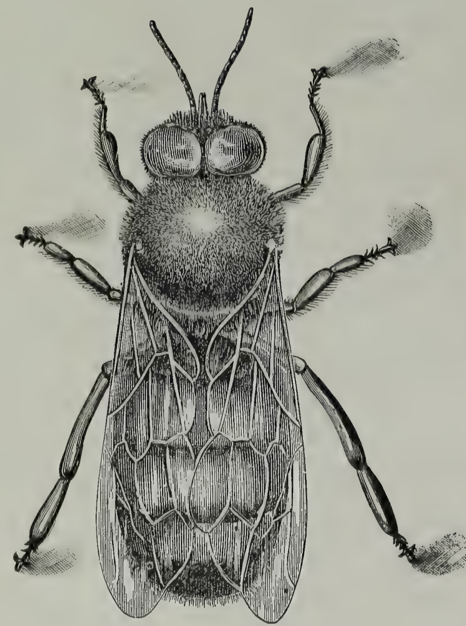
* Carniolans are much inclined to do this at any time of the year.

† Recent reports state that queens were confined in cells 4 or 5 days after they should have hatched.

Worker.



Queen.



Drone.

warmest part of the afternoon. We know of no prettier or more interesting sight to the apiarist than the first flight of a queen. She runs this way and that, somewhat as does a young bee, only apparently much more excited at the prospect of soaring aloft in the soft summer air. Finally she tremblingly spreads those long silky wings, and with a graceful movement that we can not remember to have seen equaled anywhere in the whole scope of animated nature, she swings from her feet, while her long body sways pendulously as she hovers about the entrance of the hive. A worker-bee hovers also about the entrance and carefully takes its points when trying its wings for the first time; but she, seeming to feel instinctively that she is of more value to the colony than many, many workers, the young queen with the most scrupulous exactness notes every minute point and feature of the exterior of her abode, often alighting and taking wing again and again, to make sure she knows all about it. When we saw one for the first time go through all these maneuvers, we became impatient and felt like saying,—

"There! there! young lady; you certainly know where you live now; do you suppose a fellow can stay here all the afternoon, neglecting his business, just to see you start off on your first journey in life?"

By and by she ventures to circle a little way from home, always verging back soon, but being gone longer and longer each time. She sometimes goes back into the hive satisfied, without going out of sight at all; but in this case she will be sure to take a longer flight next day or a half-hour later in the same day. During these seasons she seems to be so intent on the idea she has in her little head that she forgets all about surrounding things, and, instead of being frightened as usual at your opening the hive, she will pay no attention to you; but if you lift up the comb she is on she will take her flight from that as well as from anywhere else. We have caught them in the hand at such times, without their being frightened at all; but as soon as they were allowed to go, they were off as if nothing had happened. After she is satisfied that she will know the place, she ventures out boldly; and from the fact of her circling right up in the air, we have, until lately, supposed that fertilization took place above the ken of human eyesight. This has been shown to be a mistake.

After a successful flight she returns with the organs of the drone remaining attached to her body. See DRONES. This is a white substance, and is frequently so large as to be plainly seen while she is on the wing. We should think a queen is usually gone half an hour, but we have seen them return fertilized after an absence of not more than 10 or 15 minutes.* This accomplished, she goes quietly into the hive. The bees are much inclined to chase after her, and they sometimes pull at the protruding substance as if they would drag it away. That they do so, we think is pretty well proven.

Until recently it was generally believed that the queen met the drone only once, notwithstanding the fact that Francis Huber, in his book, "New Observations," published in 1814, made the statement that queens might or might not take more than one wedding flight before beginning to lay. But this seems to have been overlooked until 1904, when considerable proof was adduced to show that the same queen *before* laying (not after) may not only take several wedding-flights, but come back on different occasions with sure evidence of having met a drone.

While it seems to be pretty well proven that the queen may take more than one marriage-flight *prior* to her laying, it is very much doubted whether she ever takes a second flight to meet the drone *after* laying, although there are some facts that seem to point that way. Against the belief that the queen meets the drone after once beginning to lay is the fact that she may receive on one of her wedding-flights enough spermatozoa—more than enough, in fact, to supply her fully for all the eggs that she can ever lay, even though she lives to be five or six years old. The number of spermatozoa has been variously estimated at from two to twenty million, which she receives at one mating. Even if we accept the lesser figure, a good queen can scarcely lay more than two hundred thousand eggs in a season, even in a southern climate; and she then would have to live ten years, which she never does, to use up all the spermatozoa she receives at her one mating.

* And sometimes for three minutes.—A. C. M.

For further particulars on this subject of mating, see DRONES.

The next day after a successful mating you will, as a general rule, find the queen depositing eggs. The average age at which queens begin laying is about nine days; we generally wait ten days from the date of hatching, and are then pretty sure of finding them ready to send off. Between impregnation and the time the first egg is laid a remarkable change takes place.

After the queen has been out and fertilized, her appearance is much the same as before. She runs and hides when the hive is opened, and looks so small and insignificant that one would not think of calling her a fertile queen. A few hours before the first egg is laid, however, her body increases remarkably in size, and, if an Italian, becomes lighter in color, and, instead of running about as before, she walks slowly and sedately, and seems to have given up all her youthful freaks, and come down to the sober business of life in supplying the cells with eggs.

HOW OLD A QUEEN MAY BE AND STILL BECOME FERTILIZED.

As we have have said before, our queens usually begin to lay when 8 or 10 days old, on the average; but during a dearth of pasturage, or when drones are scarce, they may fail to lay until three weeks old. The longest period we have ever known to elapse between the birth of a queen and her laying worker-eggs, was 25 days. We would destroy all queens that do not lay at the age of 20 days, when the season, flow of honey, flight of drones, etc., are all right. There is one important exception to this. Many times queens will not lay in the fall at all, unless a flow of honey is produced either by natural or artificial means. Queens introduced in the fall often will not lay until the ensuing spring, unless the colony is fed regularly every day for a week or ten days. Also young queens that are fertilized late in the season will often show no indications of being fertilized until the colony is fed. A lot of young queens that we thought might be fertilized but did not lay were once wintered over, just to try the experiment; and although they went into winter quarters looking very small, like virgin queens, nearly all proved fine layers in the spring.

DRONE-LAYING QUEENS.

If a queen is not fertilized in two weeks from the time she hatches, she will often commence laying without being fertilized at all. She is then what we call a drone-laying queen. Usually her eggs are not deposited in the regular order of a fertile queen, neither are there as many of them; but by these marks we are able only to guess that she may not be all right, and so keep her until some of the brood is capped, when the extra height of the cappings, as we have explained under DRONES, will tell the story. At times, however, the eggs are deposited so regularly that we are deceived, and the queen may be sold for a fertile queen, when she is only a worthless drone-layer; but this we always discover after the brood is capped, and send our customer another queen. Such a case occurs, perhaps, once in a thousand. Whether these drone-layers are just as good to furnish supplies of drones for the apiary as the drones reared from a fertile queen, is a point, we believe, not fully decided; but if you care for an opinion, we should say if the queen lays the eggs in drone comb, and the drones are large, fine, and healthy, we believe them to be just as good. We should not want to use drones reared from fertile workers, nor drones reared in worker-cells, as those from drone-laying queens sometimes are.

How to find queens, see FRAMES, TO MANIPULATE, sub-head "How to Manipulate Hoffman Frames," also "How to Handle Unspaced Frames."

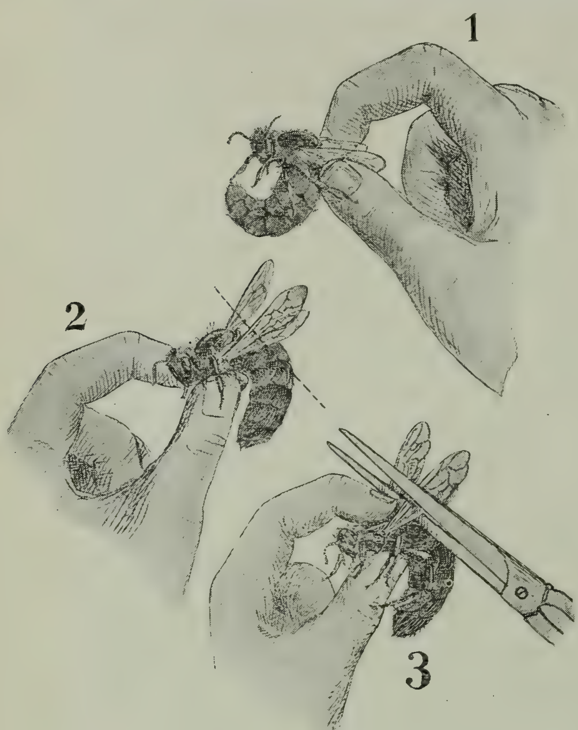
SHALL WE CLIP QUEENS' WINGS?

The majority of honey-producers practice what is known as clipping; that is, two wings on one side are cropped off, leaving merely the stumps of what were once wings. The object, of course, is to prevent swarms from going off by making it impossible for the queen to follow. See BEE BEHAVIOR, also SWARMING.

There are very few who believe or profess to believe that clipping is injurious to the queen. The fact that queens after being clipped seem to do good service for two or three years, and sometimes four, and the further fact that such queens do as well as those not clipped, would seem to show that no detrimental results follow.

HOW TO CLIP QUEENS' WINGS.

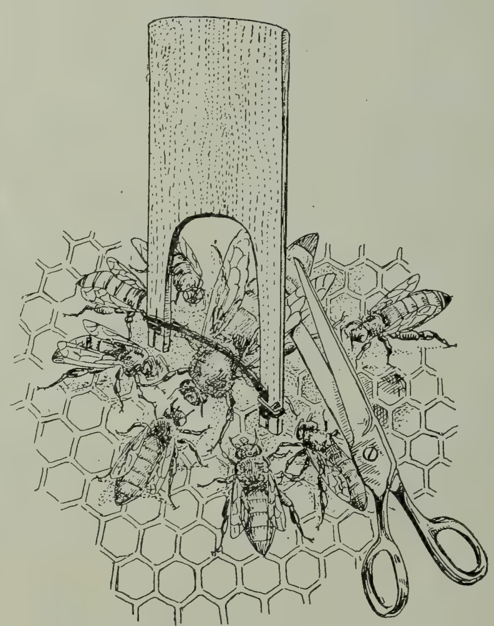
There are several ways of accomplishing this. One plan is to grasp the queen by the wings with the right hand, in the usual manner, as shown in No. 1 on this page. With the thumb and fore finger of left hand, take hold of her waist, or thorax, as at 3. In this way she can be held very securely and safely, leaving her legs as well as her wings entirely free. With a pair of slender-pointed embroidery scissors (or any kind of scissors if these are not obtainable) clip off the *two wings* on one side, leaving anywhere from 1-8 to 1-16 of an inch, and being careful not to cut too close. This accomplished, drop her gently between two frames of brood; but in no case let her fall more than an inch; for a queen during the height of the egg-laying season is liable to be injured if handled roughly. Some prefer, after picking up the queen, to grasp her by the legs as shown at 2; but this is liable to pull one or more legs off unless done just right, and we therefore recommend plan 3.



Manner of holding a queen during the act of clipping.

Now, before you attempt any one of these plans, if you have had no experience you should first practice on drones. If these are not to be found, try picking up worker bees by the wings until you become reasonably expert; but don't attempt to put a worker between the thumb and finger of the other hand, as you will run a good chance of being stung. For this part of the work get drones if possible. Then, when you can do both operations well, try a queen. Even then we advise the attempt on one of not much value, as it is a nice piece of work to do it well.

Sometimes in an outyard, when a pair of scissors is not to be had, we use a sharp blade of a penknife. This is passed under the two wings in such a way as to cause them to bear directly upon the edge of the blade. The thumb is now pressed down upon the wings over the blade, and then drawn back and forth seesaw fashion, perhaps two or three times. If the knife is sharp, the wings will be severed with two or three strokes. If it is dull, the queen should be laid on her back, still holding her between the thumb and finger of the left hand so that her wings will bear directly upon a hive-cover or any other piece of board or wood. The edge of the knife should be brought to bear upon the wings, when a slight pressure will cause the blade to pass through them.



Willis queen-clipping device and how used.

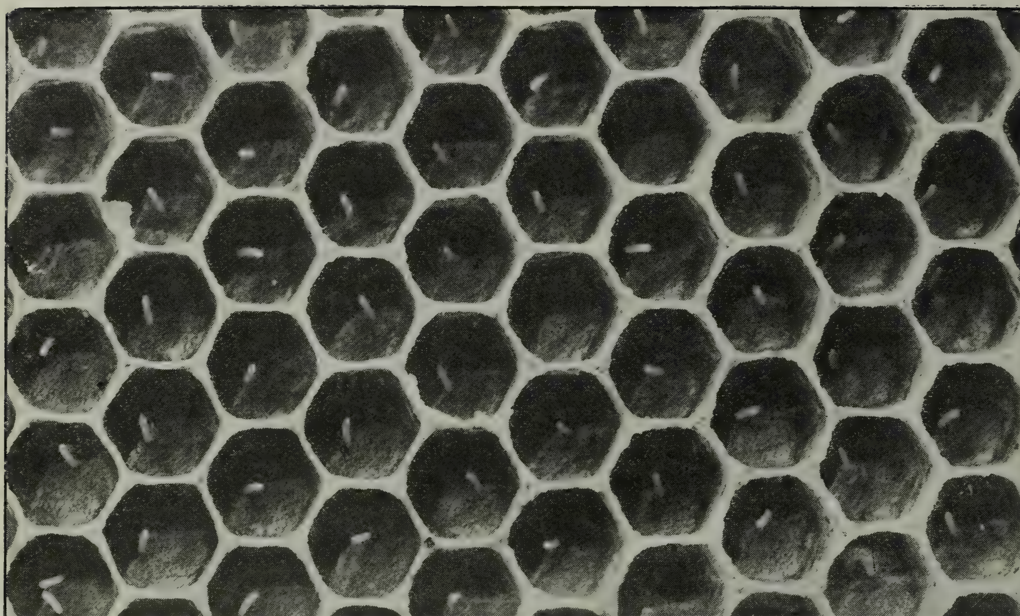
During these operations be careful to handle a queen only by the wings or the thorax. This way avoids all danger of hurting her in the least, providing you are not too clumsy. But always be careful not to press the abdomen of any queen.

A very simple device and something any one can make is shown in the last illustration. It consists of a piece of section stuff 1-8 inch thick, whittled out as shown. The two ends of the prong are split, and a light rubber band secured in the manner indicated.

This band must be stretched just tight enough so that, when the implement straddles a bee, the rubber band will hold it securely. For the purpose of determining just when the right amount of tension is secured, try it on common bees as they walk across on the combs. It it fails to hold one of them the band should be stretched a little tighter; and if not then sufficient, a heavier band should be used. After having perfected it on ordinary bees, use it on a queen-bee, and clip her wings in the manner shown.

This is the invention of Mr. R. D. Willis, of Montrose, Col.; and after having tested the same we find that the implement works very satisfactorily.

Greiner's method of clipping without handling the queen.



Close view of eggs. Notice the cell in the lower left-hand corner contains two eggs, while that at the right-hand corner has a larva.

In handling, the fingers sometimes taint the queens and cause bees to ball them after they have been clipped. This little device would obviate any trouble of that kind.

There are some beekeepers, among whom may be mentioned Friedman Greiner, of New York, who prefer to clip the queen without picking her up off the comb. One edge of the frame is rested on the hive, as shown, while the free hand with a pair of fine-pointed scissors quickly clips the wings of her majesty as she stops for a moment on the comb.

Practice first on drones or workers before essaying the act on a queen. It is needful to work quickly and with considerable precision. Clumsy movements will be liable to cripple a queen seriously. It would be better to pick her up and follow any other method described.

HOW QUEENS LAY TWO KINDS OF EGGS.

That queens lay two kinds of eggs no one now is inclined to dispute, since the experiments with the microscope have decided the matter so clearly, as given under Drones. Suppose a young queen goes out to meet the drones so late in the fall or so early in the spring that there are none; what is the consequence? Well, sometimes she will never lay at all; but frequently she commences to lay when 3 or 4 weeks old, and her eggs produce only drones. In fact, she can produce no other eggs, having never been fertilized. How shall we distinguish such queens from fertile ones?

We can not decide positively concerning them, by any means we know now, until their brood is ready to seal up; then we will know by the round, raised cappings of the brood, like bullets laid on a board, as we explained under Drones. We can give a pretty good guess by noticing the way in which she lays the eggs; if they are few and scattering, and sometimes, or often, in drone-cells, coupled with the fact that she did not commence laying until two weeks or more old, we had better not send her off as an untested queen until some of her brood is sealed over. A young queen, if properly fertilized, never, or very rarely, lays an egg in a drone-cell; and when she commences to lay, she fills cell after cell in regular order, as men plant hills of corn; her work also has a neat and finished appearance that says at once to the expert, "She is all right."

Now, do not think us contradictory when we tell you that a young queen in rare cases does begin with all, or nearly all, drone eggs, but, after a while, lays entirely worker eggs as regularly as one could

wish.* We do not know why this is; perhaps she has not yet got used to the "machinery." Once more, you must bear with us in telling you that any queen, the best one you ever saw, is liable, any day of her life, to begin laying drone eggs altogether, or in part. A nice laying young queen, taken from a hive, and shipped to a distance, may prove to be a drone-layer shortly after or immediately after she is received. Such things are not very common, but they do occur. In an apiary of 50 or 100 hives we should expect to find one drone-layer, on an average, each spring. During the summer, perhaps one more will be found. It may be that the queen was not fertilized sufficiently, if we may use the term, and that the supply of spermatozoa gave out while she was in full vigor, thus reducing her to the condition of a virgin queen. Microscopic examination has shown an entire absence of spermatozoa in at least one or two instances where queens of this kind were killed and dissected. Similar experiments given by Dzierzon show that the spermatozoa may be injured beyond recovery by chilling the queen, and yet the queen herself be resuscitated. We think it likely that hardship and being shipped long distances may produce the same results. Do not think we are going to excuse those who sell queens, and let the blame for unprofitable queens slip off their shoulders; on the contrary, we think they had better make up their minds to render a full equivalent for all the money they get. When a queen proves a drone-layer before the purchaser can receive any benefit from her, another should be sent.

Well, queens not only turn suddenly to drone-layers, but they sometimes produce about an equal number of each kind of eggs. In all these cases, where the queen lays drone eggs when she evidently intended to lay worker eggs, they are in worker-cells; also the number of eggs laid usually rapidly decreases. The bees, as well as queen, evidently begin to think that something is wrong; queen-cells are soon started, and after the young queen is hatched she becomes fertile, and begins to help her mother. All hands evidently think that any kind of queen is better than none, hence a queen is seldom dragged out of the hive, as a worker-bee is, because she is ailing.

Very early in the spring, late in the fall, or at any time when forage is not abundant, a queen will pass right by drone-cells, taking no notice of them. We have often tried to get eggs in drone-cells by feeding, but conclude that the queen knows what an egg will produce, and just how to have every egg laid in a drone-cell produce a drone. Very likely the workers have something to do with this matter, but we have never been able to make out by what means they signify to the queen that some eggs in drone-cells, or even queen-cells, would be desirable. There seems to be a constant understanding in the hive as to what is going to be done next, and consequently there is no clashing. In our apiary there seems to be, in strong stocks, a kind of understanding that eggs shall be laid in drone-cells about the last of March, and we have drones, therefore, some time in April, ready for the first queens that may, by any accident, make their appearance. Those who insist that there is only one kind of eggs can satisfy themselves very easily by taking an egg from either a drone or worker cell and placing it in the bottom of a cell of the other kind. They will get a drone in a worker-cell, or a worker in a drone-cell. Again: If you give a young laying queen a hive supplied only with drone combs, she will rear worker brood in these drone-cells, and the mouth of the cells will be contracted with wax.

When bees get ready to swarm they build shallow queen-cells, in which the queen then lays a worker-egg. Although we never saw her lay an egg in a queen-cell, we are satisfied that she does it, from the way in which it is put in. Like the rest of the eggs, it is fastened to the center of the bottom of the cell by one of its ends, and we suppose, when first deposited, it is covered with a sort of glutinous matter that makes it stick firmly where it first touches. We know that bees have the skill to remove both eggs and larvæ, for we have several times known them to take eggs and brood to an old dry comb when no queen was present in the hive.

* It has been suggested that this phenomenon may be accounted for by the fact that fertile workers were in the hive before the young queen began to lay; and the drone eggs are not from the queen but the fertile workers, and that, when the queen begins, she lays worker eggs at the very start, while the fertile workers are destroyed, and hence the drone eggs disappear. We are free to admit this is possible.

Occasionally a queen is found that will never lay at all; again, queens that laid eggs which never hatched into larvæ have been several times reported. We have had several such, and they were in appearance fine nice-looking queens.

After having told you thus much of the faults and imperfections of queens, we would add, for their credit, that when once properly installed in a good strong colony they are about as safe property as any thing, because, in the great majority of cases, they live and thrive for years. We have never heard of any disease among queens, and, while a worker lives only a few months, queens often live 3 or 4 years. One that was imported from Italy by Dadant furnished us brood and eggs for queen-rearing for four summers. We then sold her for $2.00, and she died in being sent less than 50 miles. She was very large and heavy, and, probably, being so old could not cling to the sides of the cage like a younger one.

LOSS OF QUEEN.

It is a very important matter to be able to know at once when a queen is lost. During the months of May and June the loss of a queen from the hive a single day will make quite a marked difference in the honey crop. If we assume the number of eggs a queen can lay in a day to be 3000, by taking her away a single day we might be just that number of bees short right during a yield of honey. To put it very moderately, a quart of bees might be taken out of the hive by simply caging the queen for a single day. Beginners should remember this, for their untimely, or, rather, inconsiderate tinkering, just before the flow of honey comes, often cuts short their income to a very considerable degree. Whatever is done, it is very important not to drop the queens off the combs when they are handled at this time of the year, nor should we needlessly interrupt the queen in her work by changing the combs about so as to expose the brood or upset the little household matters of the bees.

With a little practice you will be able to detect a queenless hive simply by the way the bees behave themselves on the outside. When they stand around on the alighting-board in a listless sort of way, with no bees going in with pollen, when other colonies are thus engaged, it is well to open the hive and take a look at them. If you find eggs and worker-brood you may be sure a queen is there; but if you do not, proceed at once to see if there is not a queen of some kind in the hive, that does not lay. If you do not find one, give them a frame containing brood and eggs, and see if they start queen-cells. You ought to be able to find incipient ones in about twelve hours, if the bees have been some little time queenless. As soon as you see these, give them a queen if possible. If no queen is to be had, they may be allowed to raise one, if the colony has bees enough. If it has not, they should be united with some other stock.

THE CRY OF DISTRESS FROM A QUEENLESS COLONY.

As a general thing a queenless colony will set up a peculiar cry—that is to say, the bees all through the hive will be buzzing as if in distress, and they surely are, because they have no queen. As soon as a hive of this kind is opened they will begin this cry of distress. Sometimes only a part of the bees will be involved, and at other times apparently every bee in the colony. This buzzing of the wings is so marked that the practiced beekeeper recognizes it as an indication of queenlessness; and if he finds no eggs nor young brood at a time of the year when both should be present, he is quite sure that the hive has no queen. If he finds queen-cells, all doubt will be removed. Sometimes a colony that is not queenless will set up a buzzing as if they were without a mother. It is then evident that the show of distress is not because they have no queen but because of the disturbance. Too much smoke, for example, with most colonies and a little smoke with some colonies will cause them to make this sign of distress. It must therefore be regarded as not an infallible sign of queenlessness.

ODOR OF A LAYING QUEEN.

After bees have been some time queenless they usually become, if no fertile or laying workers make their appearance (see Laying Workers), very eager for the presence of a queen; and we can in no way describe this eager behavior, if we may so term it, so well as to describe another way of test-

ing a colony you have reason to think is queenless. Take a cage or box containing a laying queen and hold either the cage or simply the cover of it over the bees, or hold it in such a way as to let let one corner touch the frames. If queenless, the first that catch the scent of the piece of wood on which the queen has been, will begin to move their wings in token of rejoicing, and soon you will have nearly the whole swarm hanging to the cage or cover. When they behave in this manner we have never had any trouble in letting the queen right out at once. Such cases are generally where a colony is found without brood in the spring.

There is something very peculiar about the scent of a laying queen. After having had a queen on the fingers, we have had bees follow and gather about the hand, even when we had gone some distance from the apiary. By this strange instinct they will often hover for hours about the spot where the queen has alighted for even an instant, and, sometimes, for a day or two afterward. Where clipped queens get down into the grass or weeds or crawl sometimes a considerable distance from the hive, we have often found them, by watching the bees that were crawling about along the path she had taken. When cages containing queens are being carried away bees will often come and alight on the cage, making that peculiar shaking of the wings which indicates their joy on finding the queen. See SCENT OF BEES.

QUEENS' STINGS.

There is something rather strange in the fact that a queen very rarely uses her sting, even under the greatest provocation possible, unless it is toward a rival queen. In fact, they may be pinched or pulled limb from limb, without even showing any symptoms of protruding the sting at all; yet as soon as you put them in a cage or under a tumbler with another queen, the fatal sting is almost sure to be used at once. There seems to be a most wise provision in this; for if the queen used her sting on every provocation as does the worker, the prosperity of the colony would be almost constantly endangered.

We said a queen very rarely uses her sting; but it is the exception that proves the rule. The following will explain:

> One very young virgin queen that stung me was well developed and later proved to be a good queen for business. The other virgin, also very young, that stung me was from a good-looking cell, and I suppose was all right. As it was so much easier to crush her than to endure her continued stinging till I could get her out of my clothing, she was killed without knowing positively what kind of a queen she would have proved herself to be.
>
> Ceres, Cal W. A. H. GILSTRAP.

CAUTION IN REGARD TO DECIDING A STOCK TO BE QUEENLESS.

As a rule, we may say that absence of brood or eggs is a pretty sure indication of queenlessness; but it should be borne in mind that all hives, as a rule, are without eggs and brood in the fall and early winter months, or, in fact, at any time when there is a considerable dearth of pasturage. At such seasons, beginners are more apt to think their hives are queenless, because the queens are much smaller than when they are laying profusely. In weak colonies queens often cease laying during the whole of the winter months. See INTRODUCING.

For particulars on how to find queens, see FRAMES, TO MANIPULATE.

For further particulars regarding queens, see DRONES, QUEEN-REARING, and BEE BEHAVIOR.

QUEENS, HOW TO FIND. — See FRAMES, TO MANIPULATE, sub-head, "How to Manipulate Hoffman Frames;" also "How to Handle Unspaced Frames."

R

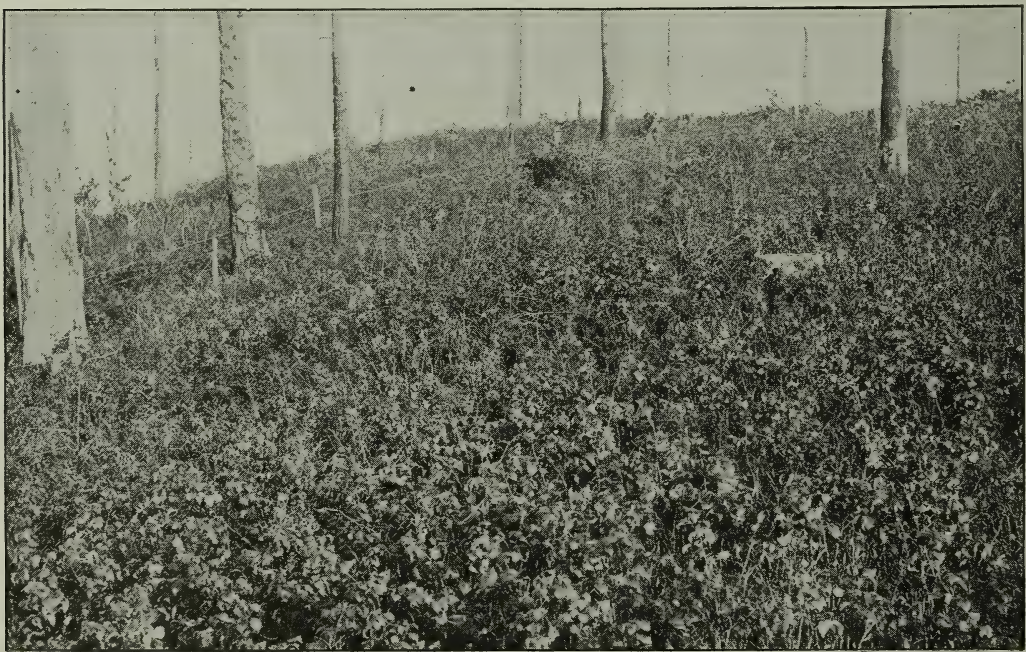
RASPBERRY (*Rubus idaeus,* Var. *R.,* now classified as *Aculeatissimus*).—Where this fruit is raised largely for the market it is quite an important honey plant; but it would hardly be advisable to think of raising it for honey alone. Bees work on it closely in our locality, and its honey is of the very finest. If beekeepers and growers of small fruits could locate near each other it would probably be a benefit to both. Langstroth says of the raspberry honey: "In flavor it is superior to that from white clover, while its delicate comb almost melts in the mouth. When it is in blossom, bees hold even white clover in light esteem. Its drooping blossoms protect the honey from moisture, and bees work upon it when the weather is so wet they can obtain nothing from the upright blossoms of the white clover."

In our locality it comes in bloom just after fruit blossoms and just before clover, so that large fields of it are a great acquisition indeed. The red varieties (especially the Cuthbert) are said to furnish most honey.

WILD RASPBERRY OF NORTHERN MICHIGAN.

This deserves special mention here for the reason that large quantities of raspberry honey are produced in Northern Michigan where forests of pine timber formerly grew. The fact that such land is very cheap, and almost useless for any thing but timber-growing, which, under present conditions, can not get a start, make the business of honey-producing profitable and reasonably sure, for it is probable that the plant will continue to flourish, as there is nothing else that is adapted to take its place. The blossoms commence yielding honey in June, and continue to bloom more or less from then till frost.

As Langstroth says of it above, the honey is of the finest quality, and will rank in almost any market with the best clover.



Wild raspberry of Northern Michigan.

Indeed, connoisseurs pronounce it superior to any other table honey in the world, for it partakes somewhat of the beautiful flavor of the berry itself, with all the added qualities that are so much prized in clover.*

The Michigan fruit ripens in July, and continues available for picking till frost.

The drawback about this wild raspberry is that the fruit will not keep for shipping, and it must, therefore, be used almost the same day it is picked.

RATS.—Rats may and can do a great deal of damage in a honey-house. There are some old fellows that are cute enough to avoid traps and poison. The only thing to do with such is to shoot them by watching when they congregate about five o'clock in the afternoon in and about the outbuildings. A 32-caliber Flobert rifle with shot cartridges, or, better, a taxidermist's 44-caliber shotgun, will do very good execution.

One of the best traps that was ever made is the old-fashioned rabbit-trap with grain spread on the bottom of the box. The trigger to close the trap should extend down to the grain. The rats in eating will bump against the trigger and set it off, when they are imprisoned alive, after which they can be drowned.

Poison can be given in the form of dough made of one-fifth part of barium carbonate, or barytes, and four-fifths meal. This poison has no odor nor taste; and it is better than strychnine because its action is slower, giving the rats a chance to get off the premises before they die.

RECORD-KEEPING OF HIVES.—Almost every apiarist has a plan of his own, whereby he can record the condition of the hive at the time of its examination, so that, in future, without depending on memory, he may tell at a glance what its condition was when last examined.

Many of the large honey-producers, Dr. Miller among them, have what they call a "record-book." This book has a page for each colony, the number of the page corresponding with the number of the colony. The book should be small and compact, just about right to carry in the hip-pocket, and securely bound. It should always be carried when at work among the bees. On each page is supposed to be a record of each colony's doings within a year—when it became queenless, when it had cells or brood, when it swarmed, and, toward winter, the strength and quantity of stores it had when last examined.

There is an advantage in the book method—and that is, the book can be consulted in the house, and the work mapped out beforehand for the day. If the record book be for an out-apiary, the work can be planned while riding to the yard; and, upon arrival, the plans formulated can be executed. We will know in advance just where we are going to get cells to give to queenless colonies; just which colonies will be likely to have laying queens; which ones may cast swarms, and which ones will be likely to need more room in the way of sections or surplus combs. There is one objection to the record-book, however. It is liable to be lost, or to be left out in the rain; and if the book is lost, the whole knowledge of the apiary, except so far as the apiarist can remember, is gone. Another thing, only one can use the book at a time.

Others prefer card indexes. Each hive in the apiary will have a number, and corresponding to that number will be a card. Boxes of these card indexes can usually be obtained at the stationer's or at the bookstores at a moderate price. The advantage of such index is that, when some particular card for some hive is full, it can be replaced by another card bearing the same number or added data. But the most important advantage is that one can look through his index at home; and when he comes across a card, the corresponding hive of which requires some particular attention, he can remove that card entirely from the index; and so on he can remove the cards of all other colonies of the yard requiring special attention. These cards can then be slipped into the hip pockets and carried to an outyard or handed to an assistant with proper instructions; and after the hives have received the requisite attention, the necessary record can be attached. On returning home the cards can be replaced.

Where there is a series of outyards, one should have one index for each yard. As

* It was one of the honeys which, *blended* with clover and basswood, originally gave the fame to "clover honey" in New York and New England.—A. C. M.

there will seldom be more than 200 colonies to the yard, one can have an index of 200 cards. For example, yard No. 1 will have cards up to 199; yard No. 2 from 200 to 399; yard No. 3 from 400 to 599, and so on. If any of the cards should get mislaid or get mixed with another index, the first figure of the number will indicate to what yard or index it belongs. For example, we would know that card 346 would belong to yard No. 2, or the Jones yard, as the case might be.

For the purpose of queen-rearing, the card index is invaluable because it enables one to keep a complete record of a queen, even her pedigree for several generations back. When she is sold, the record can be made, showing to whom she was sold, so that, if the purchaser complains that her bees are not pure, or that the colony is diseased, the breeder can easily go to the identical colony from which she came, and prove or disprove either assertion.

The value of the card index can be materially increased by the use of colored cards, to slip into the index here and there to indicate immediate or early attention to some particular number. As the apiarist goes over his records the colored cards will indicate just where the cards are, referring to a specific colony. Let us suppose a case. We will say that No. 241 at the time of our examination looked suspicious. We fear the presence of foul brood. A red card is put right in front of card 241, for red indicates danger. Blue, green, and yellow cards may be used to indicate other conditions such as queenlessness, short of stores, failing queen, about to swarm, etc. If one is making preparations to feed he will hunt over the blue cards. Either pull the cards back of them out of the index or note down on a slip of paper the numbers of the hives that require feeding.

In this connection it should, perhaps, be stated that one can purchase, at very small expense, note-books with an alphabetical or numerical index. These books are so constructed that any particular page can be removed and another page substituted or added, on the principle of loose-leaf ledgers. Such books can be used in place of a card index. In other words, it will be a pocket card index that can be carried to and from the yard; and as such books are usually bound in leather they will stand rough usage.

Of course, with any books or card index*, it goes without saying that *every* hive in the yard should be numbered. These numbers may be applied on the hive with a brush, using black paint. But it is preferable to use a detachable number. Such a number may be stenciled on a sheet of tin and the tin tacked on the hive. The objection to these is the expense. Fortunately there can now be secured of supply dealers numbers printed on heavy manilla tags that are afterward soaked in boiling paraffine so they will stand the weather. These numbers can then be tacked on the cover, or on one side or end of the hive. As a general rule it is better to use the front end just over the entrance. In the course of two or three years it may be necessary to replace the old number with a new and fresh one. As these card numbers are very cheap the expense of renewal is small.

RECORD-KEEPING IN OR ON THE HIVE.

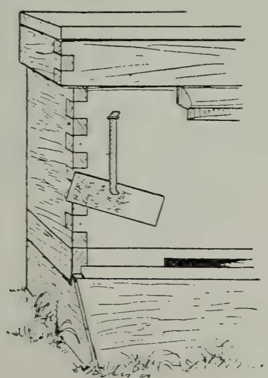
There are many beekeepers who think they can not afford to fuss with books, card indexes, nor any thing of that sort. Some of them simply write the record inside of the cover; but in most cases the form or make of cover renders this impracticable.

One of the best schemes we have yet seen to accommodate this class of beekeepers is what we may call, for want of a better name, wooden writing tablets. These are made out of broken sections, $1\frac{1}{2}$ or 2 inches wide, by four or five inches long. But these, unless dipped in white lead, will soon weather-stain so that the lead-pencil record will be blurred if not entirely obliterated. To coat a thousand of these, dip in thin white lead, and lean against something until dry. In every case after they are painted they will hold lead-pencil records the entire season. At our yards we used both the card index and the wooden slate tablets coated with white lead. The tablets are for a temporary record, which record is later transferred to the card index. In connection with the white tablets we use some painted different colors to indicate different conditions of the colony.

* Use section stock dipped in white paint, and print on this. I have had such for five years, and good as new now.—A. C. M.

For instance, one can stand in one position in the yard, and at a glance can easily locate one colony having a blue, red, yellow, or green tablet, each color carrying its own special significance.

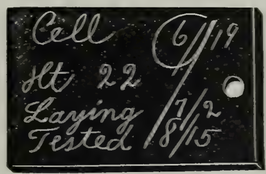
But these wooden tablets will blow off the hives, and become lost. This difficulty is easily overcome by the use of little spring clips made of brass; and in lieu of any thing better, the ordinary steel super springs coated with paint make a very good substitute. Each spring clip should be fastened down with a staple. The advantage of these clips is that they not only hold the tablets fast to the hive, but they enable one to place the tablet in front or on top. Where a colony needs attention at the next visit, a red tablet is placed on top of the white one bearing the record. If a colony needs feeding, a blue tablet will be used; if it is queenless, a green one; and so on one can use a great variety of colors to indicate as many conditions of the colony. But in most cases a red tablet may be used to show any thing that requires immediate attention. For example, here is a colony that is starting to build queen-cells. At the next trip those cells will need to be cut out to forestall swarming; and again a red card may indicate a failing queen, or a poor queen which needs replacing soon; a colony that is on the verge of starvation, a colony that has suspicious-looking brood, that will need another examination a week hence before its nature can be fully determined; and so on a red card may be used to indicate any conditions that need rectifying at the time of the next visit.


Spring clips.

The spring clips should usually be made out of brass, and those we use are made of that material, 24 gauge, ¼ inch wide, and about 4 inches long, bent as shown in the illustration.

The whole outfit—brass clips, brass staples, wooden tablets of different colors, etc., can be obtained of your dealer, if you do not care to fuss to make them yourself. But where one is a producer of comb honey he will have many pieces of broken sections, which, when dipped in white lead, will be equal to any to be obtained of his dealer.

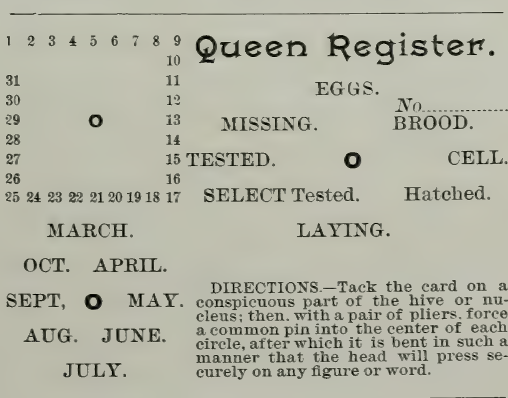
Some years ago we used small slate tablets. They were nothing more nor less than miniature slates without frames cut as shown in the illustration. An ordinary slate or lead pencil was used to make the



record. These have one advantage over the wooden tablets on account of their weight. They can usually be laid on top of a hive cover without danger of their being blown off. But the serious difficulty with them lay in the fact that they were expensive. Another objection to them is that the pencil records would wash off in the first hard dashing rain, and the lead-pencil records would become almost illegible.

QUEEN-REGISTER CARDS.

Another system of record-keeping that is popular with some is what are called



register-cards. The accompanying plan shows how they are used. To indicate the date, the pin heads are revolved so as to point to the proper place. There is no

writing, and nothing to do except to turn the pointers to the right place. This was preferred by the late W. Z. Hutchinson and others.

RED CLOVER.—See CLOVER.

REVERSING.—This, as the term signifies, is the process of inverting, or turning over, the combs; and this may be accomplished by inverting the several frames individually or the whole hive at one operation. The subject began to be discussed in 1884; and for three or four years following there was much said on the subject. Reversible frames and reversible hives were invented by the dozen. Some of them were quite ingenious, while others were clumsy and impractical.

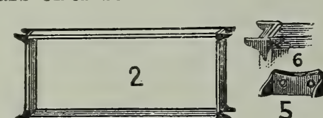
Taking into consideration the fact that the bees store their honey just immediately over the brood, and, as a consequence, their combs at this point would be much better filled out, certain beekeepers conceived the idea of turning the combs upside down at frequent intervals. "Why," said they, "when the combs are reversed, bringing the bottom-bars uppermost, the combs will be built clear out to the bottom-bars, and the honey now in the bottom of the combs will be carried up into the supers, just where it is wanted." This seemed very nice in theory, and even in practice it seemed to be partially carried out; for a good many beekeepers reported that, when the combs were reversed, the bees, rather than have the honey in the bottom of the combs, near the entrance, and accessible to robbers, would uncap it and take it up into the sections. But the result was, that often poor and dark honey went up above; more often, we believe, the bees allowed the honey to stay at the bottom of the hive, and the only real advantage secured was getting the combs filled actually to the bottom-bars, being now at the top.

A very few claimed that reversing, when done at the proper time, would destroy queen-cells, and so control swarming. But it did not—at least in *our* case.

After all, the real and direct advantage of reversing is in the matter of getting combs filled out in brood-frames as solid as a board. See BEE BEHAVIOR and FRAMES, TO MANIPULATE. When hunting queens it is much easier to find one where there is no horizontal space between the edge of the comb and the bottom-bar, and no holes to furnish her hiding-places. Then, of course, having combs filled out solid gives better fastening to the frame and increases the capacity of the hive just in proportion to the new comb built after reversing. Nearly every frame that is not reversed is liable to have a space of ½ inch or ⅜ between the bottom of the bottom-bar and the comb; and this is a waste that ought to be utilized if possible. To a certain extent this space can be filled in non-reversing frames by having sheets of foundation reach from frame-bottom to top-bar, wired in with perpendicular wires; but even such combs are never as well filled as those reversed.

Several good reversible frames have been proposed; but we would never think of adopting any of them unless it had some points of merit outside the one exclusive feature of reversing. A reversible frame that is not good for all-around use would be very unprofitable.

One of the first practical reversing frames was the Van Deusen, having metal corners or ears. This is essentially a standing frame, and can be used just as well one side up as the other. The frames are spaced apart by "spacing-ears," and these very ears offer some distinctive advantages

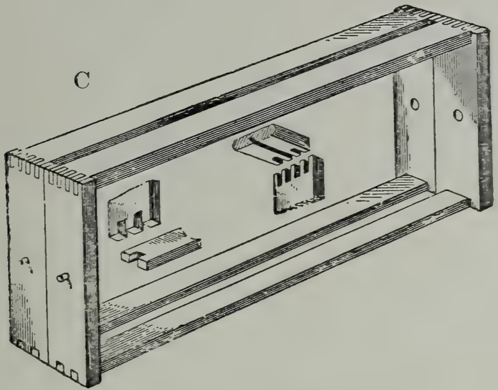


The Van Deusen Reversible Frame.

in the way of handling the frame. This frame was used very largely by the one-time most extensive beekeeper in the world, the late Capt. J. E. Hetherington; also by his brother in Michigan. Outside of its reversing feature it offers one very decided advantage; namely, the facility with which it can be handled like the leaves of a book. By taking out one or two frames the rest can be thumbed over without lifting them out of the hive.

Two other very excellent reversible frames are the Danzenbaker and the Heddon (see HIVES; also FRAMES, SELF-SPACING, and FRAMES, TO MANIPULATE), either one of which can be used as well one side up as the other; in fact, any closed-end

standing frame can be used as a reversible frame, except the Quinby. For further



Danzenbaker's Reversible Frame.

consideration of this subject see booklet, "Facts about Bees," by E. R. Root, published by The A. I. Root Co.

ROBBING.—Paul says, "The *love* of money is the root of all evil." We should be inclined to state it in this way: The disposition to get money without rendering an equivalent is the root of all evil. Well, the root of a great many evils in beekeeping is the disposition of the bees to gain honey without rendering any equivalent. One of our A B C class has said that he found bees making visits to over 100 clover-heads before they obtained a load sufficient to carry to their hives. It is probably true that during a great part of the season a bee will be absent a full hour, or, it may be, during unfavorable spells, as much as two hours, in obtaining a single load. The time during which they may be absent is very variable. If the nectar secretion is heavy they will return much quicker than where it is light. Is it at all strange that a bee, after having labored thus hard during the fore part of the day, should, in the afternoon, take a notion to see if it could not make a living in some easier way? Would it be very much worse than many types of humanity? Well, as it passes around to other hives it catches the perfume of the clover honey they have gathered in a like manner, and, by some sort of an operation in its little head, it figures out that, if it could abstract some of this, unperceived, and get it safely into its own hive, it would be so much the richer. We presume it has no sort of care whether these other bees die of starvation or not. That is none of its concern.

With all their wonderful instincts, we have never been able to gather that the bees of one hive ever have any spark of solicitude as to the welfare of their neighbors. If, by loss of a queen, the population of any hive becomes weak, and the bees too old to defend their stores, the very moment the fact is discovered by other colonies they rush in and knock down the sentinels, with the most perfect indifference, plunder the ruined home of its last bit of provision, and then rejoice in their own home, it may be but a yard away, while their defrauded neighbors are so weak from starvation as to have fallen to the bottom of the hive, being only just able to attempt feebly to crawl out at the entrance. Had it been some of their own flock, the case would have been very different indeed; for the first bee of a starving colony will carry food around to its comrades, as soon as it has imbibed enough of the food furnished to have the strength to stagger to them.

Well, suppose the bee mentioned above, in prowling around in the afternoon or some other time, should find a colony so weak or so careless that it could slip in unobserved, and get a load from some of the unsealed cells, and get out again. After it has passed the sentinels outside it usually runs little danger from the inmates, for they seem to take it for granted that every bee inside is one of their number. There is danger, though; for should it betray too great haste in repairing to the combs of honey they often suspect something; so it assumes an indifference it is far from feeling, and loiters about very much as if it were at home, and finally, with a very well-assumed air of one who thinks he will take a lunch, it goes to the cells and commences to fill up. Very often, when it gets pretty well "podded out" with its load, some bee approaches, apparently to see if all is right. When the robber once gets its head into a cell, however, it seems to have lost all sense or reason; and if it is discovered at this stage to be a stranger and a thief, it is often pounced upon and stung with very little ceremony. How do they know a stranger from one of their own number, where there are so many? It is said they tell by

the sense of smell; this may be the principal means, perhaps, but apparently they depend greatly on the actions and behavior of a bee, much as we do when judging of the responsibility of a man who asks to be trusted. We can give a very good guess, simply by his air or manner, or even by the sort of letter he writes. If a robber is suspected, and a bee approaches for the purpose of satisfying itself, it is a very critical moment, and one becomes intensely interested in watching the performance. The robber will stand its ground, if it is an old hand, and permit itself to be looked over with wonderful indifference; but one who has watched such scenes closely will detect a certain uneasiness, and a disposition to move slowly toward the entrance, that it may be the better able to get out quickly, when it discovers things to be too hot for it inside. If the bee that first suspects it concludes it is an interloper, it begins to bite it, and grab hold of its wings to hold on until others can come to help. The thief has now two chances to escape, and sometimes it seems meditating which to adopt; one is, to brave it out until they shall perhaps let it alone, and then slip out unobserved. The other is, to break away and trust to its heels and wings. The latter plan is the one generally adopted, unless it is a very old and "hardened sinner" in the business. One that has been many times in such scrapes will usually get away, by the latter plan, by an adroit series of twists, turns, and tumbles, even though three or four bees have hold of it at once. Some of these fellows, by a sudden and unexpected dash, will liberate themselves in a manner that is also wonderful, and then, as if to show their audacity, will wheel about and come back close to the noses of their retainers of a minute before.

In case the bee secures its load and makes its way out unobserved, it gets home very quickly, you may be sure, and, under the influence of this new passion for easily replenishing its hive with the coveted sweets, it rushes out with a vehemence never known under any other circumstances. Back it goes and repeats the operation, with several of its comrades at its heels. Does it tell them where to go? We wish to digress enough here to say that we do not believe in a so-called language among bees, or animals in general, further than certain simple sounds which they utter, and which we may learn to interpret almost if not quite as well as they do. When a bee comes into the hives in such unusual haste, podded out with its load in a way also rather unusual when obtained from ordinary stores, its comrades at once notice it, and, either from memory or instinct, they are suddenly seized with the same kind of passion and excitement. Those who have had experience at the gambling-table, or in wild speculations of other kinds, can understand the fierce and reckless spirit that stirs these little fellows. Well, the bees, when they see a comrade return in the way mentioned, seem to know, without any verbal explanation, that the plunder is stolen. Anxious to have "a finger in the pie," they tumble out of the hive, and look about, and perhaps listen, too, to find where the spoil is to be had. If they have, at any former time, been robbing any particular hive, they will repair at once to that; but if it is found well guarded, those used to the business will proceed to examine every hive in the apiary.

INTELLIGENCE OF THE HONEYBEE.

One afternoon, the door of the honey-house being left open, the bees were soon doing a "land-office" business before the mischief was stopped by closing the door until they had clustered on the windows in the room, which were then opened, and the process repeated until all were out. All the rest of the afternoon they were hovering about the door. Toward night they gradually disappeared; and when we went down, about sundown, to try a new feeder, not a bee was near the door. We put the feeder in front of a hive where the bees were clustered out; and as soon as a few bees had got a taste, and filled themselves, they of course went into the hive to unload. We expected a lot to come out, as soon as these entered with their precious loads, but were much astonished to see an eager crowd come tumbling out as if they were going to swarm, still more when they rushed right past the feeder and took wing for—where do you suppose? the honey-house door, of course. How should they reason otherwise, than that it had again been left open, and that was

where these incomers had found their rich loads? On finding it closed, back to the hive they came, to repeat the maneuvers over and over.

As another evidence of the wonderful intelligence and almost reasoning power of the honey-bee, we will make an extract from *Gleanings in Bee Culture.* This item was written by A. I. Root.

On the 12th of September a shipment of honey came in, with two 60-pound cans so badly damaged that the contents had leaked out and run through the floor of the box car. The railroad company had agreed to take the car away at half-past ten; and as the weather was cool the bees had not discovered it at that time. Unfortunately the company failed to move the car as agreed, and I knew nothing of it till I was apprised something was wrong by the unusual number of bees swarming around the windows and doors of the factory. Then I made a little row in camp. We carried a hose over to the leaky car and washed away the honey, cleaning it from the gearing, ironwork, and under side of the car until the bees were pretty well satisfied there was nothing more to get, although they were hanging around in great numbers. To prevent the bees from getting the honey inside the car, our boys covered the floor pretty well with sawdust. About three o'clock the engine came around and pulled the car away. A little after four, some men who were loading wheat informed us our bees were making them a great deal of trouble. I at once jumped to the conclusion that the company, instead of taking the car entirely away, as agreed, had only removed it to another location in the yard, and that the sticky car was still enticing our bees. I went over, saw the sawdust on the floor on which they were dumping bags of wheat, and concluded it was the honey-car; but while I was puzzling my head to account for the fact that the ironwork under this car showed no trace of honey or water either, a man called to me and pointed to *another* car in still another location, just swarming with bees around its door, inside and out. Then I "caught on." Do you see the point, friends? There was not a particle of honey in or around either of the two cars I was looking at. After the honey-car had been pulled clear out of town, the bees, not willing to give up, proceeded to "leave no stone unturned," and were investigating every car having an open door that, in their judgment, *might* be the one that had been pulled away. When they found one with sawdust spread over the floor they naturally concluded *that* was the car, and got down on their hands and knees (figuratively) searching in the sawdust for honey. The other bees, seeing them thus employed, naturally concluded this was the place. Others, having learned that one box car contained so rich a find, concluded that a search through all the cars in the yard might possibly reward them for their investigation; and it was only in the cool of the evening that they were willing to stop digging in that sawdust, and be convinced there were no more honey-cars about.

Now, friends, it may not be true that bees recognize colors, but they certainly do take in the general makeup of objects. They are not only able to recognize a hive, but they know a box car at sight; and even if you move it to a different location they take in its general appearance so that they know pretty well how to find it in case of removal. I am not prepared to prove that they read the letters "Big Four" on the side of that car, nor that they remembered there was an enormous figure 4 printed in white on the red door of the car they wanted; but I tell you they came pretty close to it.

Of course, bees have particular notes, as for joy, sorrow, anger, despair, etc., which are produced by the wings, usually when flying; but we are quite sure they are unable to communicate to each other more than a single idea. In other words, they have no faculty of telling their fellows that a lot of honey is to be had in a feeder at the entrance, and that it would better be brought in quickly, or other bees may find it. A bee goes out in the spring, and, by smelling around the buds, discovers honey and pollen; when it comes into the hive the others see it and start out to hunt up the source of supply in a similar way. For further information on this subject, see SWARMING.

If you will turn back and read ANGER OF BEES, you will get a very good idea of the causes that start bees to robbing. Read, also, BEE-HUNTING, FEEDING, and BEE BEHAVIOR. As a general thing, bees will never rob so long as plenty of honey is to be had in the fields. During a bountiful flow we have tried in vain to get bees to take any notice of honey left around the apiary. At such times we can use the extractor right in the open air, close to the sides of the hives, if need be. On one occasion we remember leaving a comb of unsealed honey on the top of a hive from morning until noon, and not a bee touched it. It seems they preferred to go to the clover-fields in the regular way rather than to take several pounds from the top of a neighboring hive. We can readily suppose that they did not have to visit anything like a hundred blossoms at this time, and perhaps they secured a load in going to not more than a half-dozen. The first indication of robbing which you will probably have will be the cool and wicked way of stinging that we have described in ANGER OF BEES.

After the season begins to fail, you may expect that every colony in the apiary will be tried. As a rule, any fair colony will have sentinels posted to guard the entrance as soon as there is any need of such precaution. The bee that presumes to think it may enter for plunder will be led off by "the ear," if we may so express it, and this will be repeated until it learns that there is no chance for peculation at that house. At

the close of the honey harvest we should be sure that there are no weak colonies, especially if they are queenless that may be overpowered, for one such may start the fashion of robbing, and make it a much harder matter to control the propensity. An apiary, like a community, may get so demoralized that thieving becomes a universal mania. "A stitch in time will save" a great many more than nine in this case. The space occupied by the bees also should be in proportion to their numbers. Give them only so many combs as they can cover, if you wish them defended properly from either moths or robbers. Colonies without either queen or brood are not apt to fight for their stores very vigorously, so it will be well to see that they have either one or both, should there be an attack made on them. It is hardly necessary to repeat what has been said about Italians being better to defend themselves than the common bees. A few Italians will often protect the hive better than a whole swarm of black bees.

HOW TO KNOW ROBBER-BEES.

It sometimes puzzles beginners exceedingly to know whether the bees that come out are robbers, or ordinary inmates of the hive out for a general playspell. Indeed, there are times when a playspell looks very much like robbing.

When the robber-bee approaches a hive, it has a sly, guilty look, and flies with its legs spread in a rather unusual way, as if it wanted to be ready to use its heels as well as wings if required. It will move cautiously up to the entrance, and quickly dodge back as soon as it sees a bee coming toward it. If it is promptly grabbed on attempting to go in, you need have but little fear. When a bee goes in and you can not definitely determine whether it is a robber or not, keep a close watch on all the bees coming out. This is a very sure way of telling when robbers have got a start, even at its very commencement. A bee, in going to the fields, comes out leisurely, and takes wing with but little trouble, because it has no load. Its body is also slim, for it has no honey with it. A bee that has stolen a load is generally plump and full; and as it comes out it has a hurried and "guilty look;" besides, it is almost always wiping its mouth, like a man who has just come out of a beer-shop. Most of all, it finds it a little difficult to take wing, as bees ordinarily do, because of the weight. In BEE-HUNTING we related how a bee, laden with thick undiluted honey, would stagger under its load before it could take wing for the final trip home. Well, the bee, when coming out of the hive with honey it has very likely just uncapped, feels instinctively that it will be quite apt to tumble unless able to take wing from some elevated position, and therefore crawls up the side of the hive before launching out. When first taking wing it falls a little by the weight of its load, before its wings are fully under control, and therefore, instead of starting out as a bee ordinarily does, it takes a downward curve, coming quite near the ground before rising safely and surely. With a little practice you can tell a robber at first glance by its way of coming out of the hive, particularly by that fashion of running up the side of the hive before taking wing.

HOW TO TELL WHERE THE ROBBERS BELONG.

If you are a bee-hunter you will probably line them to their hive without any trouble; but if you are not, you can easily find from which hive they come by sprinkling them with flour as they come out of the hive being robbed. Now watch the other hives, and see where you find the floured bees going in. We can generally tell in a very few minutes, by the excited actions of the robbers, already mentioned. If you find that the robbing is confined to one or two colonies, as is often the case, put them down cellar and keep them there for several days where they can not incite other colonies. Reference will be made to this further on.

HOW TO STOP ROBBING.

As to the best mode of procedure, a good deal will depend on circumstances. When bees in the whole apiary are robbing in a wholesale way from the honey-house, or from any place where a supply of honey or syrup is kept, the obvious remedy is to shut the door of the dwelling to cut off the supply. If the bees have entered a barrel through the bunghole, the chances are we shall find, after the head of the barrel is taken out, that there is a peck or more of

bees swimming around in the honey. If robbing became very bad we would drive the bung into the barrel, and then, after the uproar has quieted down, remove it and run the honey through a strainer from the bunghole.

Bees soon stop robbing when all sweets within their reach are removed or so protected that they can not get at them; but even then the apiary will be out of balance for the rest of the day, and more or less for two or three days following, because the bees will be trying to find where they can find more sweets.

Sometimes robbing is started by some one in the neighborhood making sweet pickles, canning fruit, or doing any thing that causes a strong odor of sweet or sour during its preparation; then the only thing the beekeeper can do is to have the house screened; or if the case is very bad, and the bees keep on "sticking their noses into other people's business," we would recommend smoking the entrances of all the hives with tobacco smoke. Half a dozen whiffs of smoke should be blown into each entrance, one after the other. In half an hour the dose should be repeated. This will cause the bees to quiet down until such time as the canning-work or the pickle-making is over at the house where bees are "making themselves too familiar."

The best treatment for a general robbing throughout the apiary is prevention. The screen* doors and other openings into the honey-house should be self-closing. Unless they are, some one will be almost sure to forget and leave one of them open. If the doors are not self-closing, then all the honey that is stored in the building should be put into hives, shipping-cases, cans, barrels, or any receptacle where bees can be kept from helping themselves; then if perchance the door is left open no harm will be done.

ONCE A ROBBER, ALWAYS A ROBBER.

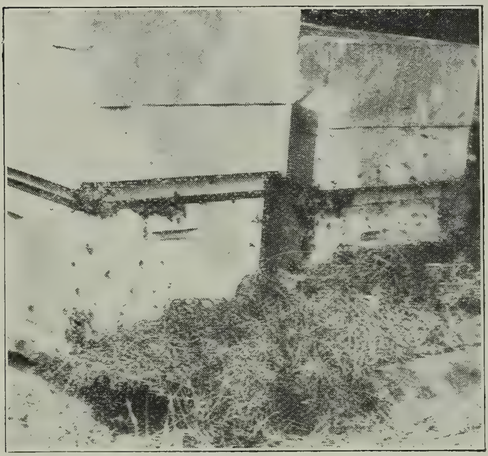
After robber bees once get into a building it is a mistake to let them out again; for no sooner are they out than they are at their old tricks again. It is better to confine them, and then after they have been imprisoned for 24 hours they may be brushed down into a box from the screen or from whatever portion of the building they may have clustered in. They should then be carried to an outyard. We would not advise letting them loose again in the same yard where they have learned their bad tricks of stealing; for if allowed their liberty they will be continually prowling around for days to see where they can effect an entrance to the honey-house or an unguarded hive. We do not know but it will be cheaper in the end to kill them outright, especially if there are not more than half a pound of bees. If there are many more, it may be desirable to save them; but *do not let them loose again in the same yard* unless you wish to invite trouble.

* Have the doors solid, and screens at the windows, then bees hang around there and not around the doors.—A. C. M.

ROBBING OF NUCLEI OR WEAK COLONIES.

There is another kind of robbing that is much more common, and which is apt to perplex the beginner more than any thing else, and that is the onslaughts that are often made on weak colonies or those that are disinclined to make a defense, especially if queenless. Nuclei with large entrances are especially subject to the attacks of bees from strong stocks, and will very often be cleaned out entirely before the apiarist discovers the mischief. By that time the whole apiary will be in a perfect uproar; and as soon as the supply of honey has been exhausted in the one nucleus the robbers will hover around all other entrances, and on finding one poorly defended they will get in more bad work later. During a dearth of honey there are always some bees that make a business of smelling around, and it is a wise precaution always to have the entrances of nuclei contracted down to a width where only one or two bees can pass at a time. We will suppose that a hive has been overpowered, and that its own bees are making no defense, realizing, probably, that resistance is useless. If any thing is to be done to save the colony it must be done quickly. One way is to grasp up a handful of long grass, strew it closely around the entrance, and then spray or sprinkle a dipperful of water on it, and scatter more wet grass over the entrance. A very little carbolic acid added to the water makes the spray more offensive to robbers. The invaders will not, as a rule,

crawl through the wet grass to get into the hive, while on the other hand those that have already entered the hive will get out and return to their homes. In the mean time the regular inmates of the hive, as soon as they are given a little assistance,



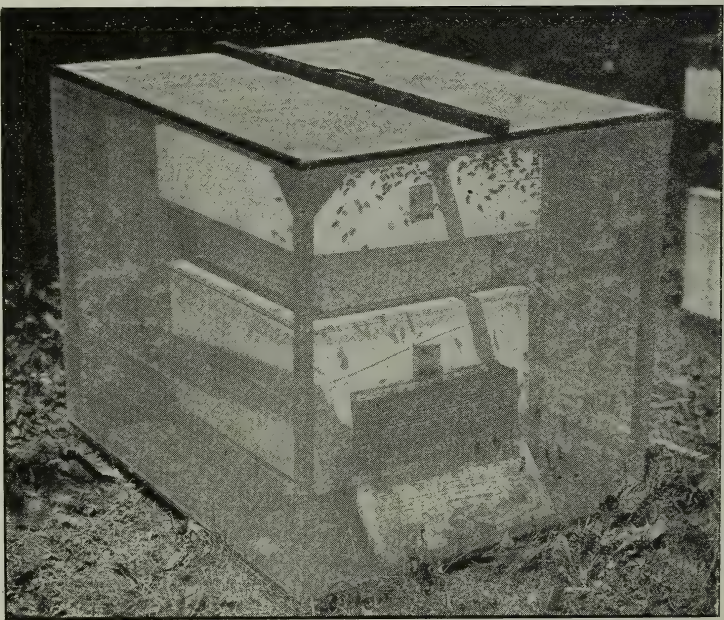
Preventing robbing by covering the entrance with wet hay.

will begin to set up a defense. The grass should be kept wet for at least an hour or two, and possibly till sundown; but before strewing the grass on the entrance we would advise contracting it down so that only one or two bees can pass at a time. *Never close the entrance up entirely,* no matter how bad the bees are robbing. On a hot day the large number of robbers in the hive, together with the regular inmates, would be almost sure to smother to death.

Another and a better way to treat colonies or nuclei that are not making a good defense is to carry them down cellar or put them in any cool place where they will have an opportunity to recover themselves, and where, too, robbers can not continually keep up the policy of pestering the life out of them. In 24 hours the robbers in the yard will have quieted down, when the nucleus or robbed colony can be taken out and set back on its stand. But at this time the entrance should be contracted down to a space just wide enough so that only two or three bees can pass at a time.

A still better plan for the treatment of a colony that is being overpowered by robbers is to set a wire-cloth cage or tent over it. This cage need not be larger than will cover the hive. The illustration shows the style that we have been using. We have three or four of such cages in the yard ready for an emergency of this kind.

It is proper to remark that we do not have robbing except when the regular apiarist is temporarily away and a new man has been left in charge. Such a man or boy will sometimes let robbing get well under way, not knowing that trouble is brewing. In very short order it will be apparent that the colony or the nucleus is not making a defense. Sometimes even a strong colony will be taken by surprise, and before it is aware of what is up the robbers will be piling into the hive at a furious rate. At other times there are not enough bees in a nucleus to make a respectable defense. Such colonies or nuclei need help, and that right speedily. If we have one of these wire cages, we set it right over the hive, and that immediately



Convenient cage to set over hive that is being robbed.

stops any more robbers from getting in. As soon as the marauders in the hive fill up, they will rush out of the entrance pellmell; but instead of going back to their own hive they discover they are imprisoned in the cage. In the mean time there will be a big horde of robbers outside of the cage. It is our practice to raise this cage up for three or four seconds, when all the outside robbers will pounce on the entrance. Right here the reader may think we are making a mistake. Our policy is to catch every robber that has been carrying on the business of stealing for the last few minutes or half-hour, so as they come back from their hive we lift their cage at intervals and let them in. The bees that have been imprisoned will cling to the top of the cage, even though it be lifted for the moment. In the mean time their number will be reinforced by more robbers coming out of the hive. In the space of about thirty minutes, if the robbing has not been going on too long, every robber will be in the top of the cage, and there they will stay. It is a serious mistake to let such bees loose again, for they will immediately go back to their hives and return to attack the colony that has been overpowered.

Toward night we lift the cage off the hive; set it down carefully till the next day, when they will be found clustered up in the top of the cage, perhaps in one corner. We now scoop them all off with a dipper, after using a little smoke, and dump them into a box. We next take them to an outyard, where every thing will be strange to them, and give them to a colony that needs a few more bees, taking the precaution, however, to cage the queen, as the new bees might kill her.

It has been said, "Once a thief always a thief;" and while the statement applies to the human family, it is true of robber bees—"Once a robber always a robber." We have sometimes doubted whether it is best to let these robbers loose after they have once been trapped. This reminds us that robber traps can sometimes be used to good advantage.

ROBBER-TRAPS.

Their purpose is to catch the hardened "old sinners"—bees that are professionals in the art of robbing, and which are of but little practical value for the purpose of getting honey honestly from the fields. We catch these shiny-backed bees and kill them. While some protest has been raised on the ground that they might be made over into a colony, yet the kind of "old sinners" to which we have referred are useless for *any* purpose. In a queen-rearing yard the sooner they are out of the way the better for all concerned. As long as they are allowed to prey on their honest neighbors they will *continue* to make work in the yard disagreeable by keeping every colony stirred up and more or less cross, despoil baby nuclei, and make trouble generally. But this is not all. They incite other bees to rob. The force of example is very potent among bees as well as human beings.

While one does not need to use traps continuously, they are required on occasions; for if a few bees once get started to robbing they will day after day pounce on the combs every time a hive is opened, and render life miserable for their owner and for the baby nuclei. Time and time again in our yards we have restored every thing to absolute order and quiet by the use of the trap. It works like magic; and after the rascals are caught, one will be surprised to note how *few* bees can make such an uproar as is evidenced by the number in the trap. Their intrinsic value is practically nothing, even if they were good honest bees. To let them loose would only invite more trouble. The amount of honey that they might gather if they could be "reformed" would be a very insignificant item. But the amount of damage that they can do in interfering with our queen-rearing operations is no small item.

It has been suggested that, if a robber-trap will catch robbers, it will also catch *honest* bees, and why destroy good property? There is no need for catching any thing but the hardened old sinners—those that we consider hopeless beyond redemption. As explained, we do not run the trap continuously throughout the season—perhaps one or two days in a whole year, and not even then if no robbers show up.

How do we avoid catching honest bees? Easy enough. The traps are put in operation only when the prowling thieves are around. They are constantly on the alert, skilled as they are in the art of stealing

and finding any exposed sweets; that is to say, they are ever following one about, while the honest bees are either in the field or hive.

Let us assume a case. After we have been working in the yard a few days there are a few robbers that accumulate. But we do not let them continue on with their nosing into other people's business till they make work in the yard exceedingly disagreeable, and the colonies that are being worked, cross. Before they become very numerous, two or three robber-traps are put into operation; and in an hour absolute peace is restored—not a prowler in sight.

The value of the trap depends on the fact that it stops a would-be bad case of robbing *before* it has progressed to any extent. A little syrup (and a very little) is put into one or two traps. The robbers, because hunting for sweets, are caught *long before* any honest bees think of looking for them.

CONSTRUCTION OF ROBBER-TRAPS.

Let us now look over one of these traps at the Root apiaries and see how they are constructed. An ordinary hive, such as is used in the yard, two wire screens such as are employed for moving bees, a super-cover, and a wire-cloth-cone bee-escape, make up the complete outfit. (The ordinary Porter spring escapes for this purpose have not been found to be as satisfactory as the wire-cloth cones.) We open up the robber-trap hive, and just over the entrance of it we find a wire-cloth cone tacked up against the inside hive-front. This is made by cutting and folding a piece of wire cloth in the form of a triangle. The large end fits over the entrance, while the other end, gradually tapering to a small orifice (about 3/8 inch square), reaches nearly to the top of the hive, or within an inch of the rabbet on which the frames rest; it is then secured by double-pointed tacks as shown at the top of Fig. 1. As an additional precaution we find it desirable to have a smaller wire cone of the same construction under the larger one. Where there is only one cone the bees are liable to go back out through the entrance. Other forms of cones are shown in the two lower views of Fig. 1.

One of these traps is placed at a convenient location in the yard, when one of the wire screens for moving bees is laid on top. With a brush we smear a little diluted honey (honey is better than syrup) over the wire cloth at one end—the back one. This film of honey is spread over an

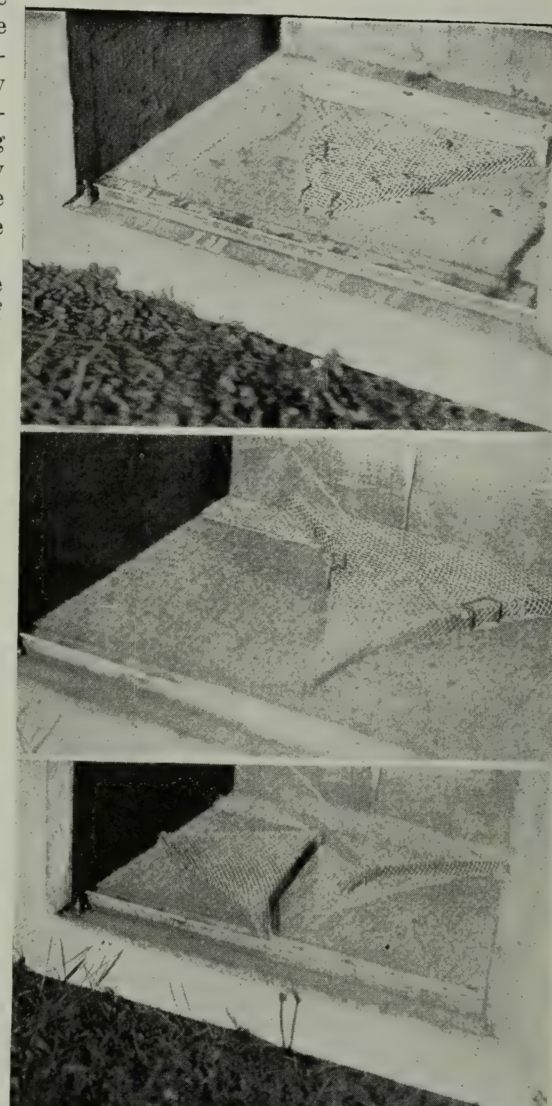


FIG. 1.—Wire-cloth-cone bee-escape on the inside of robber-traps. Note that the large end of the cone communicates with the regular entrances of the hive. Robbers pass in at the entrance up through the cone into the hive and are caught.

area of about two inches wide by the width of the screen. Another screen is placed on top of this, and over the whole is placed a super-cover, as at the left in Fig. 2. Notice that this super-cover is set back about two inches, leaving a portion of the wire cloth—the part smeared with honey—

exposed where the bees can get a *smell* of it, but not touch it, because the upper screen keeps them from it. Now, a robber-bee, if a hardened "old sinner" or a professional, when it smells honey in this way will immediately begin to "investigate." It will hover around the wire cloth (not covered by the super-cover) for a minute or two, and then, like a duck to water, it will make a dart for the entrance. There are no guards there to stop it; it rushes in pell-mell, crawls up through the two wire-cloth cones shown in the previous illustration, and out through the apex, when it is a prisoner. It may take a sip of honey, and when it gets its fill it will go toward the light at the point where the super-cover is slid backward. The chances are only one in a thousand that it will get back through the wire-cloth cones as mentioned, and it if some careless employee should happen to leave the door of the honey-house open or allow a colony to be robbed to death.

As we have before pointed out, if robbers can be caught at the very start they will be found to be mainly from one hive, and a little later from two or three. If they get well agoing they will attract other bees by their uproar; but if robber-bees be floured, and followed back to their hives, it will be seen that the great bulk of them go to only two or three hives. A yard-man has to be extremely careless to allow robbing to get started throughout the yard.

HOW THE ROBBER-TRAP CAN BE MADE TO CURE THE ROBBING NUISANCE.

It often happens that a colony will be nearly conquered by robbers, and it may be a fairly good-sized one too. The thing to

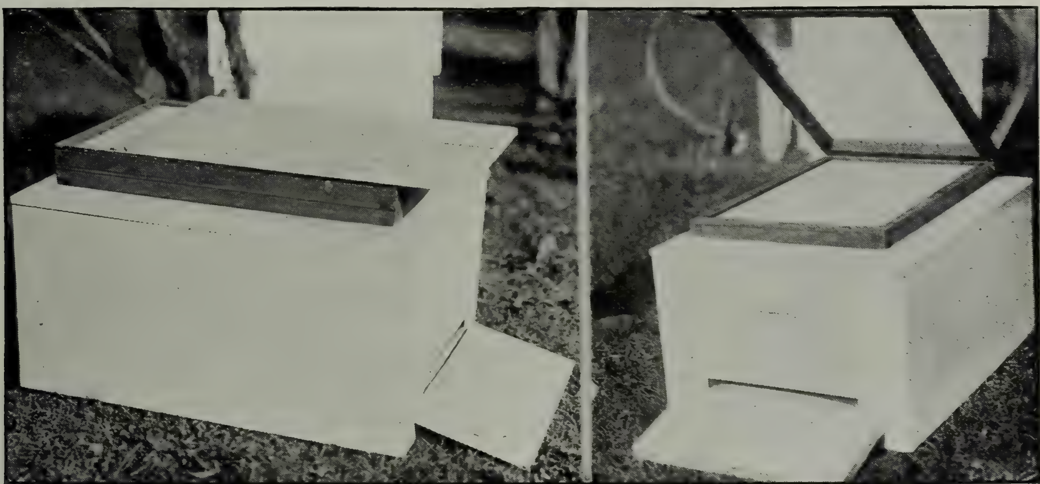


FIG. 2.—Outside detail of the robber-trap. A double screen is used, and honey is painted on the inner screen. Robbers are attracted by the odor of the honey. As they can not reach it from the outer screen they enter the hive and are trapped.

soon worries itself to death. Thus the trap works after its catches all the criminally inclined bees. The small amount of diluted honey on the inner wire cloth is used up, and automatically the robber-trap goes out of commission. The old sinners are all caught; and as there is no more honey to attract honest bees, none will be caught.

The question may arise right here, "Is the robber-trap of any use to the honey-producer?" Certainly not to the same extent that it is useful in a queen-rearing yard; but during a period of extracting there are times when it appears to us it might be used to good advantage, especially do then is to take it off its stand and put a robber-trap in its place, when, presto! the thieves will be imprisoned. In the meantime the attacked colony is taken down cellar where a window has been left open. The mauraders that don't belong there will pass outward through the window, which then should be closed. In very short order the robber-trap on the stand of the hive that was being robbed will have collected all the robbers. When every thing becomes quiet in the yard, put the trapped bees down cellar and keep them there for some days as already directed. If confined more than two days they will have to be fed.

The robbed colony, after its despoilers are caught, may now be put back on its stand, when the entrance should be contracted to about the space that one bee can pass at a time. The bees in the trap down cellar can not of course molest it; and, during the time that they are held in confinement, it will have recovered itself, and with its contracted entrance will be able to put up a very stiff defense in case another onslaught is made.

It often happens that one or two colonies will do the greater part of the robbing in an apiary. If that is the case, trap them all and then carry them to an outyard or location a mile or more from their own yard or the scenes of their recent pow-wows, where they would be only a constant menace and annoyance unless removed. If they give trouble at the outyard, trap them again, and then fumigate them to death by putting sulphur in the smoker. Better by far that they be put out of the way; for having learned bad tricks they are of no further use in the yard.

But let us suppose, for example, that no one was in the yard at the time the colony was doing the robbing; that, before we discovered what has been going on, the colony has been overpowered and nearly cleaned out. What shall we do then?

If there are not enough bees left to make up a colony or even a fair nucleus, take away all the old combs, sweep out all the dead bees, and give them a frame containing a very little honey; contract the entrance down to one bee-passage, and then watch them the next morning to see whether they will put up a defense. As a further precaution it might be well to throw a little wet grass in front of the entrance. In general, bees that are given a little rest, and a chance to recover from their demoralization, will fight very hard; and probably the second time after they have been helped a little they will be able to maintain their rights.

SWAPPING PLACES WITH THE ROBBING AND ROBBED COLONIES.

Trying to people our house-apiary in the fall, when it was first built, we had trouble with one certain colony. In fact, when robbing was going on anywhere it was sure to be these hybrids that were at the bottom of the mischief. After we had tried every plan recommended, and still finding these fellows would persist in pushing into every new colony we started, the idea occurred to us that, on the principle that it takes a rogue to catch a rogue, it would be well to try to see how these would repel other robbers. We simply took the greater part of the combs from the robbers, bees and all, carried them into the house apiary, and put them in place of the colony which they had been robbing. The effect was instantaneous. Every laden robber-bee that went home with its load, on finding the queen and brood gone from the old stand at once showed the utmost consternation, while the passion for robbing was instantly changed to grief and moaning for the lost home. The weak colony which they had been robbing, and which had only a queen-cell, was carried to them, and they soon took up with it and went to work. The robbers newly domiciled in the house-apiary repelled all invaders with such energy and determination that the rest seemed to abandon the idea which they, doubtless, had previously formed; viz., that the house-apiary was a monster hive but ill garrisoned, so we had very little trouble afterward. Before we transposed them, as mentioned, we had serious thoughts of destroying their queen, simply because they were such pests; but the year afterward, this colony gave in the house-apiary over 100 lbs. of comb honey.

HOW TO KNOW WHEN A HIVE IS PUTTING UP A GOOD DEFENSE.

The half-tone shown next page is a good illustration of how a powerful colony will deploy its sentinels or guards during the time when other colonies near by are being robbed. This colony is prepared for any kind of an onslaught; for the minute that a robber hovers over the entrance it is promptly met in mid air by one of the sentinels. They immediately clutch in a rough-and-tumble fight, drop to the ground, roll over and over, and lucky is the robber if it gets away without having its hair or legs pretty vigorously pulled. Such "a warm reception" will discourage any would-be robber from tackling that colony again. The entrance is rather wide open and the colony is strong enough to put up a defense and a vigorous one at that. If the colony were not so strong it would be

proper to contract the entrance as shown under ENTRANCES and WINTERING elsewhere.

A little way back we made reference to a wire-cloth cage large enough to be set over a hive to protect it from robbers. The

A colony that is ready to meet any kind of onslaught from robbers. Robbers had hovered around the entrance. The result was, the guards were out in good force to repel the attack.

illustration shown on page 488 will make the matter of the construction of the cage plain. It is nothing more nor less than a light framework of 7/8-square stuff held together at the intersections by means of three-cornered blocks. The whole is then covered with wire cloth, and across the top a strip is nailed to provide a handle so the cage may be lifted up with one hand. In our own apiaries we find it best to have in addition one or two larger cages—big enough to take in a man while he is operating over the hive. These cages may be of various sizes, but they should be light enough so that one can carry them around easily and squat over a hive to be manipulated. The cages that we have used are made in the same way as the small cages, of 7/8-square stuff braced at the intersections by three-cornered blocks. Cross-rails on each side two feet from the bottom serve as convenient handles, so that the man on the inside can pick up the cage and walk from one hive to another. We have found the use of cheese-cloth quite as effective as wire cloth for these large cages, and much cheaper; and we discovered, also, that it is not necessary in most cases to have the top covered. The average robber that is supposed to make trouble will hover along on a level about the top of the hive that is being operated. It does not have sense enough to rise up and dive down over the top; but in the mean time bees that belong to the hive that is being manipulated will easily escape. On the other hand, the cages that have tops will cage the bees so they will be bumping around the head of the operator. Unless they are actual robbers, it is better to let them loose; and as soon as the operator has left the hive they will go into their own entrance.

For raising queens these topless cages are very convenient when the robbing season is on. The queen-breeder, while he is on the inside of one of these cages, can work over a hive as long as he pleases, secure from robbers. If he uses the cage continually, robbers will seldom get a taste of honey; and therefore there will be little or no trouble.

We have used with considerable satisfaction another form of cage that is collapsible—that is to say, it folds up into a small compass. It is shown in the next illustration.

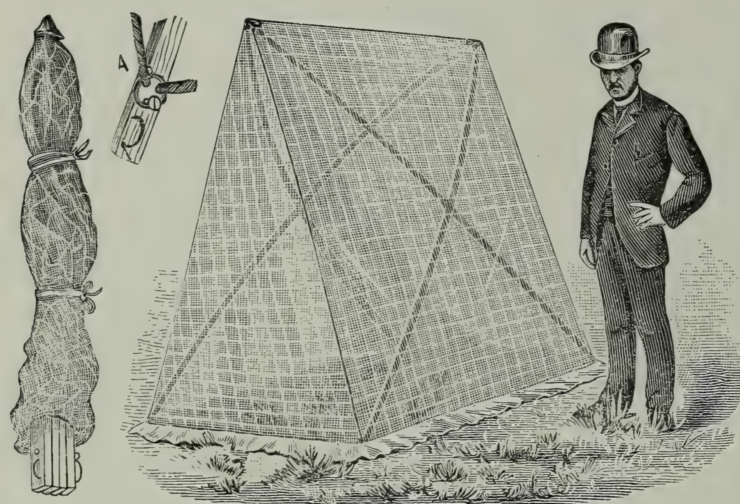
WORKING WITH BEES BY LAMPLIGHT WHEN ROBBERS ARE TROUBLESOME DURING THE DAY.

We have before mentioned our troubles in trying to people the house-apiary in the fall. Queens having been already hatched in the lamp nursery would all be lost unless the colonies were divided at once, so as to make use of them. The surplus combs for making these late swarms were in the upper stories, and the robbers knew it; for no sooner was a cap raised than they were on hand; and before we could get the brood-combs to go with them (required because the bees would not adhere even to their own combs, unless some of them contained unsealed brood), a smart traffic would be under way. It came night, and hives and queens were in all sorts of bad shapes. We were glad to have night come, we assure you, for we longed for the time when the robbers would be compelled, by the gathering darkness, to go home. Many of you have doubtless had cause to repent trying to work with bees

when it began to grow dark, but we somehow got the idea that, with some good lamps having nice shades on them, we could do work in the evening. We went at once, took a lamp, and walked around the apiary viewing the inmates of different hives clustered out at the entrances, humming merrily, we presume in remembrance of the rich loads they had but an hour before snatched from us. Scarcely a bee took wing, and we then ventured to open a hive. With the lamp on one of the posts of the trellis, we found we could handle the bees almost as well as in daylight, and, to our intense relief, not a bee would leave its hive, no matter how many combs were held temptingly under their very noses. We went to work, divided colonies, caught queens, and even handled vicious hybrids with fewer stings than we could possibly have avoided in the daytime.*

This experience of working by lamplight was at a time when an A B C scholar did not know how to control, or, better, prevent, robbing in the *day time.* But prevention is better than cure. Keep the entrances of weak colonies and nuclei contracted, and keep all sweets in a closed room or sealed cans where the bees can't get a taste, and you will have no trouble.

* Since the above was written we have found that a good lantern is preferable to a lamp. The latter is apt to be affected by light breezes, and is often blown out. The former is not open to this objection, and may receive rougher handling. During the season of 1886 we used the lantern in the apiary with entire success.



Tent folded. Folding bee-tent, ready for use.

But if you *must* open your hives much during the dearth of honey, as in the case of queen-rearing, then follow the plan now to be described.

HOW TO REMOVE THE ROBBING TENDENCY BY OUTDOOR FEEDING.

When honey is coming in fast or even slowly, of course there is no robbing; but as the nectar supply stops, bees begin to pry around to find what they can steal. At such times, when hives are opened for examination robbers will be about, and if the combs are exposed very much by such handling they will pounce upon the hive and combs in great numbers, and then attack the entrance after the hive is closed up. If one is trying to rear queens the results will be discouraging. Bees get cross, refuse to start cells, or, if built out, tear them down, and kill off drones, and destroy drone brood.

The fact that there is no robbing when honey is coming in suggests the remedy; viz., feed *outdoors* a thin syrup of the consistency of raw nectar. See FEEDING OUTDOORS.

HOW TO FEED OUT UNFINISHED SECTIONS OR WET EXTRACTING-COMBS.

While these can be scattered out in the open, it is quite sure to result in fearful robbing and stinging after the supply is exhausted. To forestall this, put the combs and sections in hives or supers, one tiered

above another on a regular bottom-board, and then contract the entrance so that *not more than one or two bees can pass at a time.* To make it wider results in a scramble and robbing of weak colonies in the yard. The top of the tier of hives or supers should, of course, be covered. While a regular hive-cover *can* be used, a wire-cloth screen is much to be preferred, to prevent suffocation. But it must be provided with a bee-escape; otherwise nearly all the visiting bees will perish, vainly trying to force an exit through the wire screen.

These tiered-up hives with small entrances are much used to clean up scraps of honey, extracting-combs, and to empty out partly finished sections. See COMB HONEY. This slow robbing also has a tendency to draw off robbers from the nuclei and weak colonies and therefore serves a double purpose.

WHAT HAPPENS IF ROBBING IS NOT STOPPED.

When robbing is under genuine headway, the honey of a strong colony will disappear in from 2 to 12 hours; the bees will then starve in the hive, or go home with the pillagers, or scatter about and die. This is not all; when the passion is fully aroused they will not hesitate to attack the strongest stocks, and you will find your bees stung to death in heaps before the entrances. This may put a stop to it, in time, but we have seen them push ahead until every hive of the apiary was in an uproar, and it seemed as if every bee had certainly gone crazy. At such times the robbers will attack passers-by in the streets, and even venture an attack on cats, dogs, aye, and hens and turkeys too. Like the American Indians when infuriated at the sight of blood, every bee seems to have a demoniacal delight in selling its life while inflicting all the torments it possibly can, feeling sad only because it can not do any more mischief.

The worst robbing time seems to be after the heaviest or main honey-flow is over, when bees become especially crazy, if they get even a smell of honey left carelessly anywhere near the hives. One who has never seen such a state of affairs can have but little idea of the furious way they sting every thing and everybody. The remedy is to get a good smoker and put in enough fuel to insure dense smoke; then, using one hand to work the smoker bellows, with the other, contract the entrance of every hive that shows any symptoms of being robbed. Shut up every bit of honey where not a bee can get at it, and do your work well; for at such times they will wedge into and get through cracks that would make one think *inch boards* were hardly protection enough. Be up betimes next morning to see that all entrances are close and small, and that all the hives are bee-tight. An experienced hand will restore peace and quietness in a very short time to such a demoralized apiary. Black bees are much worse than Italians, for the latter will usually hold their stores against any number of assailants; good, strong, well-made hives, filled with Italians, with plenty of brood in each, will be in little danger of any such "raids," although we have seen the wounded and slain piled up in heaps before robbers would desist and give up trying to force an entrance. See ANGER OF BEES.

BORROWING.

Before closing this subject of robbing there are a few more points to be mentioned. There is a kind of pillaging called borrowing, where the bees from one hive will go quietly into another, and carry away its stores as fast as gathered; but this usually happens where the robbed stock is queenless, or has an infertile queen.* As soon as they have eggs and brood, they begin to realize what the end of such work will be. This state of affairs seldom goes on long; for it either results in downright robbing, or the bees themselves put a stop to it.

Caution to Beginners.—The first year we kept bees there was constant fear that they would get to robbing, as we had read so much about it in the books. One afternoon in May we saw a large number of bees passing rapidly out and in a particular hive, and the more they were examined the more we were persuaded that they were being robbed. We contracted the entrance, but it seemed to make little difference. We finally closed it almost entirely, com-

* Golden, or bees with a fair dash of that blood, will do it at any time to any colony. They have been known to fill their own supers with plunder taken almost entirely from other colonies in the yard. They are never fussy about having their victims queenless.—A. C. M.

pelling the bees to squeeze out and in, in a way that must have been quite uncomfortable, at least. After awhile they calmed down, and we had only the ordinary number of bees going out and in. "There," thought we, "had we not read the books and known how, we might have lost our bees," and we undoubtedly felt very wise if we did not look so. On turning the head, behold, the robbers were at another colony, and they had to be put through the same program; then another and another; until we concluded a host of robbers had come from somewhere, and made a raid on the apiary, and that, had we not been on hand, the whole of them would have been ruined. We had got very nervous and fidgety, and, when we found the whole performance repeated the next day, we began to think bee culture a very trying pursuit. Well, in due course of time we figured out that there was no robbing at all, but that it was just the young bees taking their afternoon playspell, for, as we have already stated, a playspell of young bees often looks like a case of robbing.

ROCKY MOUNTAIN BEE-PLANT (*Cleome integrifolia*). This is a beautiful plant for the flower-garden, to say nothing of the honey it produces. It grows from two to three feet in height, and bears large clusters of bright pink flowers, as shown in the cut.

It grows naturally on the Rocky Mountains and in Colorado, where it is said to furnish large quantities of honey. Although it succeeds easily under cultivation we can not learn that it has ever been a pecuniary success in our locality. With this, as well as all other plants, it must be borne in mind that a fair test would require acres instead of little patches in the garden.

The engraving was copied from a larger-sized picture, in Prof. Cook's "Manual of the Apiary." During the season of 1879 we had a number of the plants growing in our honey-garden. It was, however, so much inferior in looks, as well as in the amount of honey produced, to the spider-plant, that we did not take the pains to save any of the seed. The two plants very much resemble each other, but the latter is a much stronger and finer-looking plant, and has a rank luxuriance of growth that the Rocky Mountain bee-plant lacks.

Rocky Mountain bee-plant.

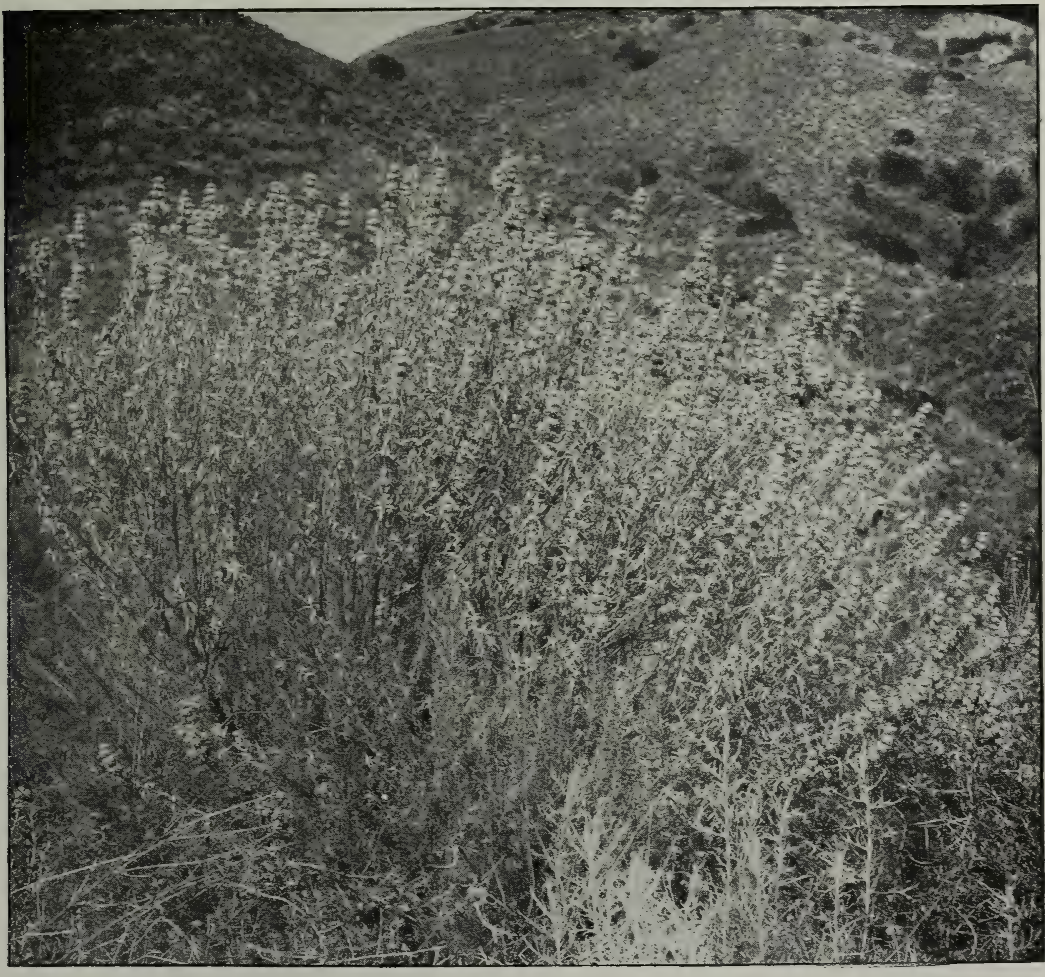
The Michigan Agricultural College experimented, in 1891, with several acres of the plant, for the sole purpose of testing its honey-producing qualities. They found it exceedingly difficult, however, to get a good stand of plants. In fact, we do not know how a perfect stand can be obtained without transplanting; and as this makes the expense equivalent to a field of cabbages or strawberries, of course the honey produced did not come anywhere near paying expenses.

ROYAL JELLY. — See QUEENS; also QUEEN-REARING.

S

SAGE.—The chief honey-plant of California, and the source of most of the surplus sage honey, is the black or button sage (*Salvia mellifera* Greene). It is unreliable every other year, and a total failure every three or four years. Next in importance is the purple or white-leaved sage (*Salvia leucophylla*). Richter says that, while this plant is not as abundant as the black and white sages, it yields a larger quantity of honey than the latter. The honey is considered superior in flavor to that of any other species of sage. The white sage (*Salvia apiana* Jep.), though very common, yields much less honey than either the black or purple sages, and the quality is less fine. The creeping sage (*Salvia sonomensis* Greene) is of more local importance, and is found chiefly in the mountains and foothills. It yields an excellent water-white honey.

The sage we have particularly to do with is the black mountain sage of California; and we do not know that it would be far out of the way to call this one of the most important honey-plants in the world. The



A bush of California button sage.

crops of honey secured from it within the past 25 years have been so immense that fine sage honey is now offered for sale in almost all the principal cities of the world, and a nice sample of well-ripened California honey, whether comb or extracted, is enough to call forth exclamations of surprise and delight from any one who thinks enough of something good to eat, and pleasant to the taste, to commit himself so far. We well remember the first taste we had of the mountain-sage honey. Mr. Langstroth was visiting us at the time, and his exclamations were much like our own, only that he declared it was almost identical in flavor with the famed honey of Hymettus, of which he had received a sample some years before. Well, this honey of Hymettus, which has been celebrated both in poetry and prose for ages past, is gathered from mountain thyme, and the botany tells us that thyme and sage not only belong to the same family, but are closely related. Therefore it is nothing strange if Mr. Langstroth was right in declaring our California honey to be almost if not quite identical in flavor with the honey of Hymettus. The California sages grow along the sides of the mountains, and blossom successively as the season advances; that is, the bees first commence work on them in the valleys, and then gradually fly higher up, as the blossoms open on the mountain side, giving them a much longer season than we have in regions not mountainous.

The late John H. Martin, who was then traveling in California, had this to say of the mountain sages. The manner in which the bee has learned how to open the trapdoor is particularly interesting.

The first sage to come into blossom is that variously called black sage, button sage, and bolled sage. Upon these buttons, or bolls, the little flower-tube appears, and is much like the flower-tube in the red-clover blossom. Flowers develop from the outer edge of the button for several weeks. The bush is about five feet in height, bearing a large number of stalks, with several buttons to the stalk, the largest one being a little over an inch in diameter, and diminishing in size toward the tip of the stalk. A tiny drop of nectar can be squeezed from the little tube, just as we can squeeze it from the tube of red clover. When the flowering season is past, the buttons turn nearly black in hue, and cling to the bush until the next season.

In habit and appearance the white sage is entirely different. The woody portion and the leaves are nearly white, which gives it its name. The flowering stalk makes a rapid growth of several feet in one season, and the plant throws out a dozen or more of these stalks, all the way from three to eight feet in height. Each stalk is loaded with racemes of buds, which continue to produce flowers for several weeks.

The description of the white sage is not complete without giving the way in which the bee sips the nectar from the white-sage blossom. The opening in the corolla is nearly large enough for the bee to thrust its head into; but, as if jealous of its treasured sweets, the flower is provided with a long projecting lip that curls up not unlike a letter S, and in such a manner as to close effectually the entrance. When I first saw a white-sage blossom, it was with much interest I speculated upon how the bee gained access to the nectar. Soon a busy work-

A stem of California button sage with blossoms.

er darted in among the flowers, and alighted upon the projecting portion of the S-shaped lip, which bent down under the weight of the bee, opening the door to its treasure-house, which the bee soon relieved of its contents. Upon the departure of the bee the door immediately closed again, to be opened and reopened by the successive foragers. When the rainfall has been light, white sage does not bloom so profusely; and, furthermore, the lip of the flower is stunted and so short that the bee can not find standing-room upon it; hence, after vainly striving to gain an entrance, it reluctantly seeks another flower with well-developed lips which readily

Stems and blossoms of California white sage.

yields to the bee, and a load is secured as quickly from this flower as from the simple tube of the button sage. It is when the sages are in blossom, in May and June, that the beekeeper has to hustle in order to keep his dish right side up.

A peculiarity of this honey is that it is not inclined to candy, but remains limpid during the severest winter weather. We have taken a sample so thick that the tumbler containing it might be turned bottom upward without its running at all, and placed it out in the snow, in the dead of winter, and failed to crystallize it. This is a very valuable quality, although it does not invariably remain clear.

Most of the white-sage honey, so called, comes from the black and button sages. The honey from these two is fully the equal of that from the white sage in body and color; hence the yield of all three varieties is known as white "sage honey" in the great markets.

SAINFOIN.—See Clover.

SCALE HIVE.—Many of our most prominent beekeepers have in their yards during the season when honey is coming a sort of barometer of the daily honey flow or, more exactly, a scale hive. This consists of a hive mounted on ordinary platform spring scales with a dial to indicate any increase or decrease in the weight of the colony. As the honey-flow begins, it will be apparent that the hive will gain slightly in weight. This weight will increase during the day that there is a fair honey-flow on and decrease somewhat during the night owing to evaporation of the nectar. As the season continues it is very easy to determine the strength of the honey-flow, what days are best, what conditions are best for a honey-flow, and when the season nears its close the dial will show a smaller and smaller increase until nothing is shown at all.

For the scale hive it is advisable to select a strong colony—one of the very best in the yard, because a medium or indifferent

one might not show any increase in weight, while the stronger colony would be able to record whether any honey at all were coming in. While of course it is understood that this strong colony would not be a fair average of all the others in the apiary, it would indicate some idea of what the nectar secretion was in the field. If, for example, our best colony would record a pound or two pounds in a day, it might be assumed that the poorer or weaker colonies would show proportionately anywhere from a half to a full pound of nectar increase in weight. Still again, our best colony on the scale might not show more than a quarter of a pound increase. Correspondingly the other colonies of the apiary might not show any gain if they were on the scale. Therefore, it is important to have the best colony we have.

One might naturally ask right here why it is important to have a scale hive. It might be argued that an expert beekeeper would be able to determine by the flight of the bees going into the hives whether a honey-flow was on, whether there was a good flow, whether it was increasing, or whether it was letting up. Very true, but the actual record of the best colony in the apiary, together with the observation of the flight of the bees at all the entrances, gives an experienced beekeeper a much more accurate idea of what is going on. In a practical way, the scale hive enables the apiarist to determine whether he should put his extra super on top of those partly filled, or whether he should place it under. See Comb Honey.

We will suppose that it is at the beginning of the honey-flow and that the bees have partly filled the first super given. If the scale hive shows a good record day by day, it would be advisable to place the next empty super *under* the one partly filled. If, on the other hand, the season is getting toward its close and the scale shows a gradual daily decrease, then it would be advisable to put the extra super on top of the one partly filled, or perhaps, better still, not put it on at all.

The scale hive is very useful also in determining how far it is advisable to continue extracting in the yard. If the season is drawing toward a close and one desires to leave enough stores in the hive for winter, or to take care of brood-rearing, in anticipation of another honey-flow to follow in another month or six weeks, then obviously it is not advisable to extract if such extracting would leave the hives without any stores, making it necessary later on to feed sugar syrup.

In a general way, it may be said that the scale hive is of value to the honey producer by enabling him to determine what policy to pursue during the season, so that in producing comb honey he will not have too many unfinished sections on his hands; or, if he is running for extracted, he will not leave his brood nests bare of honey, if he extracts at all from the brood nest as some beekeepers do. Again, there are some producers who, though they do not extract from below, desire to have left over for winter a large number of extracting combs well filled with sealed honey so that at the close of the season they can give the bees the necessary stores by simply giving these combs. In cool or cold weather they are invaluable. They save all feeding, and considerable extra time, besides the cost of sugar.

The yield per day for a strong colony of bees may vary all the way from half a pound to ten or even more pounds. Usually we estimate in the clover district two a pound to ten or even more pounds. Usually we estimate in the clover district two amount. A clover flow yields slowly while a basswood or buckwheat flow yields rapidly, and a larger daily average from the buckwheat or basswood would be expected.

SCENT OF BEES.—Any one who has observed bees has seen that they are guided very largely in their movements by the sense of smell. They have been known to fly a mile or more over water to reach flowers on an opposite bank toward which they could be guided only by scent.

The celebrated naturalist Huber first discovered that the organs of smell in the bee are located in the antennæ, and he performed some interesting experiments by cutting them off and thus depriving the bees of their power to detect odors. We have recently repeated some of his experiments on workers, drones, and queens, with some modifications, and all our results confirm his position.

Concerning the queen, Huber says, "When one of her antennæ is cut off, no change takes place in the behavior of the queen. If you cut off both antennæ near the head, this mother, formerly held in such high consideration by her people, loses all her influence, and even the maternal instinct disappears. Instead of laying her eggs in the cells she drops them here and there." As is well known, a young virgin queen is normally accepted without difficulty by any colony which has been queenless long enough to know its queenless condition. In experimenting along this line we cut the antennæ from a virgin queen about three hours old and put her on the comb of an observatory hive, and she was at once balled. This was repeated in another hive. She was then rescued from the workers, and confined in the hive in an introducing-cage containing candy, but in a short time died, probably of starvation, for we are sure she was not stung by the bees in the ball, for she was taken out at once and we never lost sight of her. Although there was candy in her cage she evidently did not recognize it as food, since she was not attracted to it by smell, and on account of the loss of her antennæ she was not fed through the meshes of the wire cloth.*

When the workers are deprived of their antennæ they remain inactive in the hive, and soon desert it since they are attracted only by light. We cut the antennæ from several workers, marked them on the thorax to make it more easy to follow their actions, and then put them in an observatory hive from which they had been taken. The other bees at once recognized that there was something wrong with them, and gathered around them much as they surround the queen, and repeatedly tried to feed them; but the injured workers could not guide their tongues, and consequently did not take food readily. One worker with its antennæ off was put on the alighting-board of its own hive, but was at once repelled and carried away by one of its own mates.

Drones act in a very similar manner, but are frequently ejected by the workers as soon as they are put in the hive. Huber reports that, as soon as the light was excluded from his observatory hive, although it was late in the afternoon, and no drones were flying out, the drones from which the antennæ had been cut deserted the hive, since light was the only thing which attracted them.

From these observations it seems clear that bees recognize each other very largely by scent, but also by touch. The workers and drones operated on were returned to their own hive, and we might suppose that they would retain the odor of that hive; but since they were not able to extend their antennæ to the other bees they were at once recognized as differing in some way, and received different treatment. Langstroth says of these experiments, "The inference is obvious, that a bee deprived of her antennæ loses the use of her intellect;" yet this statement should be modified somewhat, for the intellect is in no way influenced by the operation. The bee continues to respond normally to all sensations which it has the organs to receive, for we see that light still attracts them as it did before; but on account of the one-sided reception of stimuli its actions become abnormal.

It remains to be seen which segments of the antennæ receive certain odors, for probably they are not all alike. It has been found in ants that the different segments of the antennæ perceive different kinds of odors, and the same is very probably true of the bees.

For a further consideration of this subject see INTRODUCING QUEENS, BEE BEHAVIOR, and QUEEN REARING.

SCOUTS PRECEDING SWARM.—See ABSCONDING SWARMS, also SWARMS.

SECTIONS.—See COMB HONEY and HIVES.

SELLING HONEY. — See BOTTLING HONEY, EXTRACTED HONEY, COMB HONEY, SHIPPING CASES, and SPECIALTY IN BEES.

SELF-SPACING FRAMES. — See FRAMES, SELF-SPACING, and HIVES.

SEPARATORS.—See COMB HONEY.

SHADE FOR HIVES.—See APIARY.

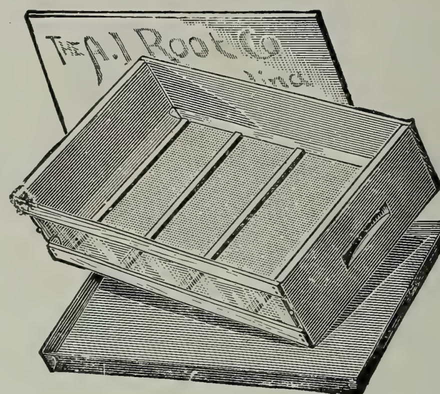
* As expressed, it leads to the inference that the bees outside did not recognize her as a queen because of the absence of antennæ. Bees will cluster on a cage containing a *laying* queen, even though her antennæ are gone. This statement referred to helps to prove that the queen has to seek her food. —A. C. M.

SHIPPING BEES.—See Moving Bees.

SHIPPING CASES FOR COMB HONEY.—It is one thing to produce a fine crop of comb honey with sections nicely filled out, well scraped and graded, and another thing to deliver that honey to market without leakage or breakage. It should be borne in mind that a section of honey is exceedingly fragile, much more so than a bottle containing pickles, syrups, or any other commodity. For many years back comb-honey producers have been putting their nicely built sections in poorly designed cases, and the result has been a large amount of breakage and leakage. This loss is usually assessed against the producer, and sometimes the item alone is enough to wipe out the entire profit of the season. When he gets his returns he is so disgusted that he either quits the business entirely or produces extracted honey only thereafter.

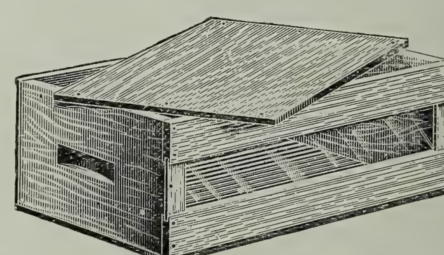
If beekeepers would be as careful in packing their product as the manufacturers of bottled goods, there would be very little complaint of broken-down combs or leaky sections, and the result would be a much larger consumption of comb honey because the dealer would then be willing to take it and push its sales. Unfortunately, there has been so much ignorance and carelessness on the part of comb-honey producers that many dealers say they will not handle comb honey again. This is most unfortunate, because the consumers demand comb honey. Almost every year there is an oversupply of extracted and a great deficiency of honey in the comb.

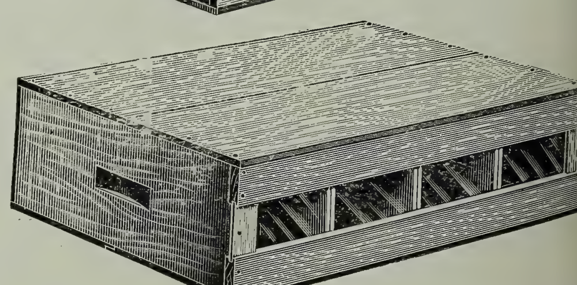
The old style of shipping cases were made of light thin stuff having a glass front with a paper tray in the bottom and cross-cleats to support the sections of honey. In the first place, this case is altogether too light to protect its fragile contents; and, in the second place, the bottom of the case, or, rather, the cleats supporting the sections, are rigid, so that whenever the case receives a bump or jar from any cause, some sections are liable to be broken. The patent-medicine men and bottlers of canned goods as already mentioned put up their goods in such a way that each separate bottle will be cushioned or protected from the ordinary rough usage that the whole package receives in the hands of the truck men and the express handlers, to say nothing of the damage received when shipped by freight. The illustration shows one of the old-style cases that provided a rigid or unyielding foundation for the



Old-style shipping case with paper drip pan and no drip cleats.

sections to rest on; namely, the wooden cross-cleats. The next two illustrations show a much more strongly built case. It will be noticed in the cut at the top that the bottom has ordinary corrugated paper

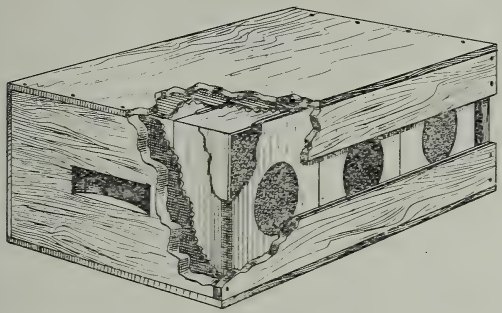




Regular 12-lb. shipping case.
Regular single-tier 24-lb. shipping case.

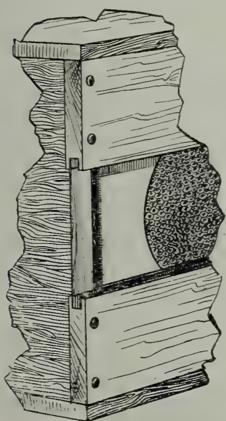
bottom, the same material that is used by the patent-medicine men in packing their bottles of medicine. In fact, we may say that the shippers of all bottled goods are using corrugated paper, not only around the bottle, but in the bottom and top of the cases. This material makes an excellent cushion, not only under the sections but at

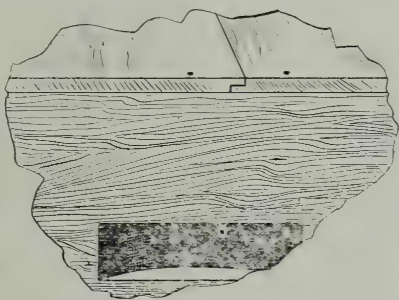
the tops, ends, and sides as well, so that when the case is dropped or receives a sudden jar the cushion of the corrugated paper absorbs a large part, if not all, of the shock. Comparative tests show that sections in a case having corrugated paper will stand much rougher usage without breakage than similar sections placed in a



12-lb. Safety shipping case.

case having rigid cleats across the bottom that of course can not absorb any of the concussion. Experience also shows that it is wiser to use narrower glass. It shows off the honey to better advantage, and at





The covers are halved at the joints to keep out ants and other insects.
Note that the pieces holding the glass are fastened securely to the ends by two nails in each.

the same time permits of the use of wider cleats in the front. When these are properly nailed, the case is much stronger.

Sometimes cross-partitions of corrugated paper are used, and at other times cartons, making use of cheap strawboard, are used, such cartons slipping around each individual section. If these are a little larger than the sections, and especially if a little deeper, they will sustain all the weight that may be placed on top of the case, leaving the section which they contain without any strain upon it. The cartons have the further advantage that they can be sold with the individual section. Thus, the delicate comb is protected not only during shipment, but while in the market basket from the grocery to the home. If there is anything that disgusts the housekeeper, it is a leaky section of honey that besmears all her other groceries, making a nasty, sticky mess of everything. If, therefore, the comb-honey producer would have the consumer pleased as well as the large dealer and buyer, he must make sure that his goods are protected clear to the consumer.

The subjoined illustrations show the details of what is called safety cases. These contain the cartons already mentioned, and also the corrugated paper at the bottom, top, sides, and ends.

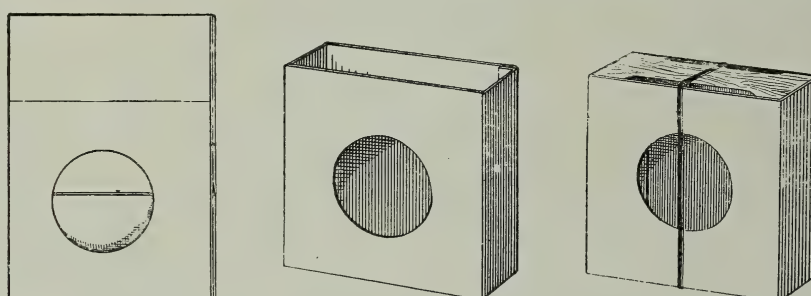
The other illustrations show how the cover-boards are halved together, and how the glass is let into the strips top and bottom. The strips, by the way, should be thoroughly nailed, two nails in each end; in fact, the case should be well nailed all over. So far as possible it should be made very rigid so that it will not spring nor twist, for if the case is at all frail the sections are almost sure to receive damage, particularly so if corrugated paper and cartons are not used.

While shipping cases containing cartons and corrugated paper built on scientific lines cost more, as a matter of course, than the old-style cases, yet the producer can well afford to use them, and he will save a considerable breakage, leakage, and no end of complaint, and, besides, avoid practically all trouble with the commission merchants or the dealers who buy the goods. It generally happens when the comb honey goes through in bad order that there is considerable correspondence back and forth as to what would be a proper adjustment. Sometimes the services of an attorney are called in, and if a suit is brought this makes all the more expense.

WHY IT PAYS TO USE BETTER SHIPPING CASES

One large buyer of comb honey who buys honey in car lots made the statement that his breakage carefully figured up in one season showed a loss to the producer

of not less than 11 3-10 per cent. If we were to take into consideration the shipments that are made from all parts of the country, in all kinds of shipping cases, this loss would reach nearer 25 per cent; but suppose we call it 20 per cent. The safety cases with cartons and corrugated paper cost about 6 or 7 cents more than the ordinary old-style cases that result in a breakage of about 20 per cent. If the breakage and leakage amount to about 20 per cent on the average, and if we allow about 50 per cent for salvage on the broken product, there is still a loss of anywhere from 35 to 50 cents per case of honey when the investment of a better case of 7 or 8 cents will save practically all of it. Let where from 1 to 2 cents per pound on the honey. The honey may be ever so nice; but if it is put up in a roughly made container it will bring a correspondingly lower price. But the most serious objection to home-made cases is their variation in size. Some of them will be too shallow, and the result will be that when the cover is nailed down it will break nearly every section in the case. Another case will be too deep and too long, with the result that the sections will rattle about in the case and break down nearly as badly. The average planing-mill man does not understand the importance of making the case absolutely accurate. The saws have very coarse teeth making rough edges, and his



Safety carton in the flat; Safety carton ready to receive sections, and how a rubber band is slipped over section and carton.

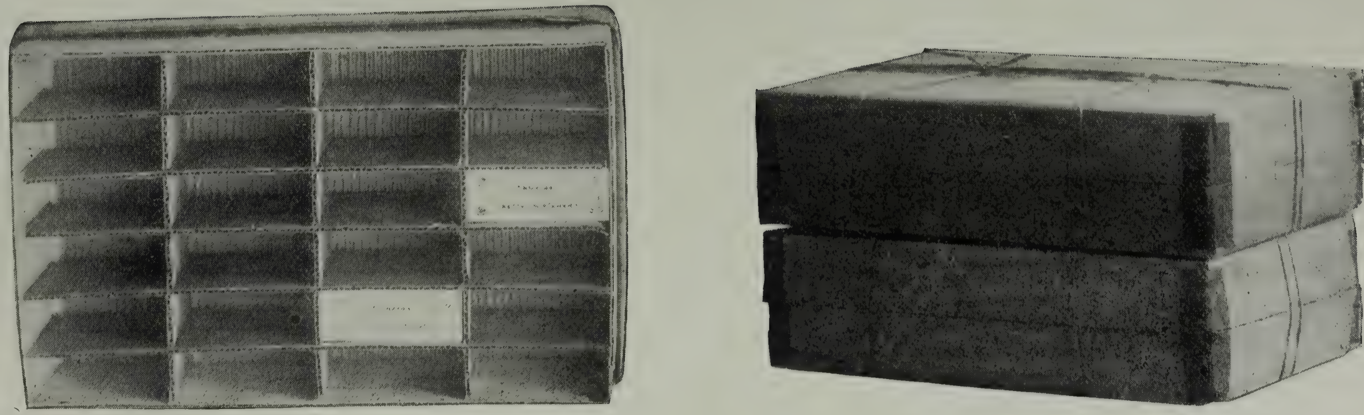
gauges are not accurate. The result is, the case or container is anything but satisfactory for shipping so expensive and fragile a product as comb honey. When a good factory-made case with cartons and corrugated paper can be bought for 25 cents in lots of a hundred, it is folly to pay a planing-mill man 15 cents a case that will bring a loss in breakage and leakage amounting to 50 per cent on the honey.

us assume that the loss from leakage and breakage in the ordinary case is 35 cents per case of 24 sections. On a crop of 20,000 pounds it would mean a loss of $300, while the extra cost of using the safety cases or those equally good would amount to only about $50.00. Plainly, here would be a saving of about $250. Moreover, the beekeeper using these better cases would get quick returns, and a satisfied customer for another year's business.

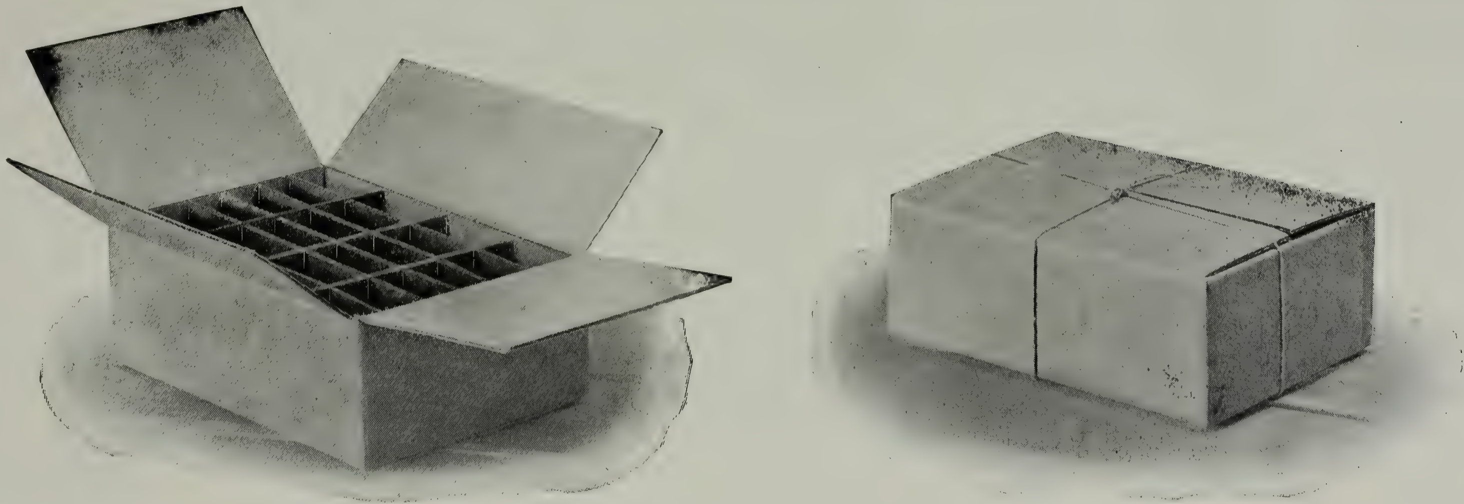
But there are a large number of beekeepers who feel that they can not even afford to purchase the cheap factory-made cases. If the loss is anywhere from 10 to 20 per cent with the cheap cases we may reasonably figure that the loss would be anywhere from 25 to 50 per cent with the ordinary home-made cases or cases made at planing-mills. The great trouble with these home-made affairs is the poor sawing, inaccuracy, and their miserable appearance. Even if the honey goes through safely the cases look so cheap and poor that the average buyer will knock off any-

SHIPPING CASES MADE OF CORRUGATED PAPER

During the last two or three years some effort has been made to use shipping cases made out of corrugated paper or strawboard—the same material that is used in the safety cases, to cushion the sections. Mr. J. E. Crane, of Middlebury, Vt., has used this kind of case for two or three years, and is well pleased with them; but some of our large commission houses and buyers of honey protest against their use. They claim that they are not strong enough to stand the rough handling of the railroad men; that as it is not practicable to put glass in them, the fragile contents of the



Crane's corrugated paper shipping cases, and inside illustration of the same. No amount of pounding on the flat injuries the honey.



Another style of corrugated paper shipping cases, and the same ready to ship.

package is not understood, and, as a result, they receive a much rougher handling. Again, it has been claimed that the paper cases will not stand rain or wet like the wooden cases. If a single section is broken down it is liable to cause the bottom of the case to soak up with honey, and this weakens the case so that it is of but little use to protect the rest of the sections.

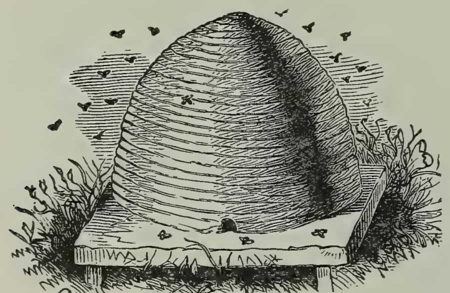
Various styles of these cases have been proposed. Those shown at the top of the previous page are those used by Mr. J. E. Crane. Those shown at the bottom can be purchased at the ordinary paper-box factories, for putting up eggs and bottled goods.

The last named provide a double thickness under the bottom and over the top of the sections, and in the knockdown or flat take less room. The design also makes a stronger case.

While such cases seem to answer very well for bottled goods, it should be remembered that a bottle of honey or a bottle of syrup or pickles will stand very much rougher handling than the ordinary section of honey. Paper cases can be bought for less money than the wooden cases, especially those of the safety kind; but experience of the last two years has shown that it would perhaps be wise not to use too many of them at the start at least. They may come into general use in time, but comb honey is so fragile an article that a wooden box is none too strong.

SIZE OF FRAMES.—See HIVES.

SKEP.—The term "skep" is often used by old-fashioned beekeepers to refer to a colony of bees in any kind of hive; but



more properly it applies to box hives and straw skeps—the last named meaning basket in old English. In England and even many of the countries on the continent of Europe, the old straw skep is still used quite largely, because lumber is expensive and straw cheap. The bees are allowed to build the combs just the same as mentioned under the head of BOX HIVES; also see HIVES, EVOLUTION OF. On top of the flat-top type of skeps, modern supers containing sections are sometimes used. The making of straw skeps for cottagers is quite a little business of itself—requiring a certain degree of skill. We do not know what these skeps are sold for, but we are told at a much less price than modern movable-frame hives.

Straw skeps are not used in this country at the present time; and if it were not for the familiar pictures of "ye oldten times" we Americans would know but little about them.

SMARTWEED.—See HEARTSEASE.

SMOKE AND SMOKERS.—We can drive cattle and horses, and, to some extent, even pigs, with a whip; but one who undertakes to drive bees without smoke will find to his sorrow that all the rest of the animal kingdom are mild in comparison, especially so far as stubbornness and fearlessness of consequences are concerned. You may kill them by thousands; you may even burn them up with fire, but the death agonies of their comrades seem only to provoke them to new fury, and they push on to the combat with a relentlessness which we can compare to nothing better than a nest of yellow-jackets that have made up their minds to die, and to make all the mischief they possibly can before dying. It is here that the power of smoke comes in; and to one who is not conversant with its use, it seems simply astonishing to see them turn about and retreat in the most perfect dismay and fright, from the effects of a puff or two of smoke from a mere fragment of rotten wood. What could we beekeepers do with bees at times, were no such potent power as smoke known? See BEE BEHAVIOR.

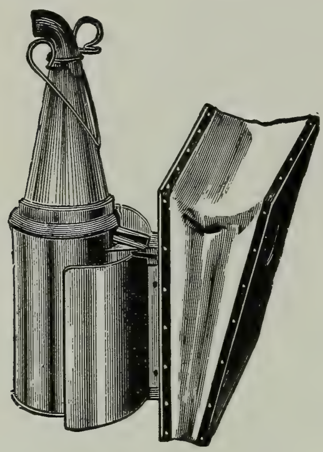
There have been various devices for getting smoke on to the bees, such as, for instance, a common tin tube having a mouthpiece at one end, and a removable cap with a vent at the other end for the issue of smoke. By blowing on the mouth-piece,

smoke can be forced out. Others, again, have used a tin pan in which was some burning rotten wood. This is put on the windward side of the hive so as to blow smoke over the frames. All of these, however, were miserable makeshifts in comparison with the smokers of to-day.

Dutch swarm specialists inspecting bargains at the bee-market in Holland. The bee-market in Bennekom, Holland. Skeps with bees and honey sell for $2.00 each.

It is to the credit of Moses Quinby for first giving us a *bellows* bee-smoker. This was a most decided step in advance over the old methods of introducing smoke among the bees. In principle his original smoker did not differ essentially from the Bingham and the L. C. Root, which were introduced later. It had, however, one serious defect; and that was, it would go out, the fire-pot not being properly ventilated to insure a good draft. Some years after, Mr. T. F. Bingham, of Farwell, Mich., and Mr. L. C. Root, son-in-law of Quinby, then of Mohawk, N. Y., but now of Stamford, Ct., introduced bee-smokers

to the world on the principle of the original Quinby bellows smoker, but with several decided improvements. The fire-cups, at the same time, were made rather larger, and were ventilated in such a way that a continuous draft could be maintained, even

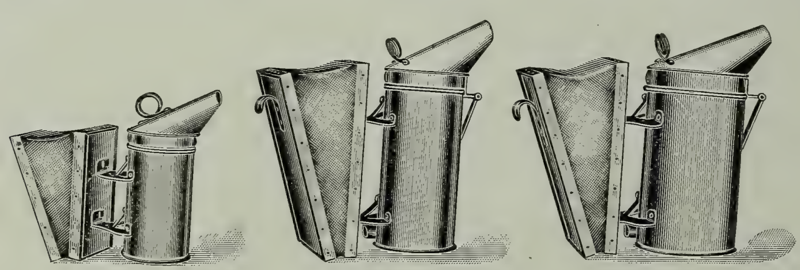


Bingham smoker.

when the smoker was not in use, thus preventing them from going out like the old original Quinby.

Of the two smokers the Bingham is the better—more reliable and more substantially made. While the L. C. Root smoker is

The improved Root smoker on the same principle with its new snout is very neat and substantial. The old-style nozzles were somewhat top heavy, having a tendency to tip over or flop open at a most inconvenient time. The ones here shown are not only compact in appearance, but will hold their position on top of the stove without danger of toppling over, no matter how roughly used. There is no reason why the nozzle or snout should be large and heavy, having a capacity rarely if ever needed. The hinge is a light skeleton stamping, yielding just enough to make it fit nicely on the smoker-barrel, and yet crowd the creosote out of the way. A very neat wire-coil handle, which will remain cool under all circumstances, is riveted securely in place on the back of the snout at a point that is most convenient for lifting and shutting the cap. It works so easily that it will not be necessary to bang or pound the nozzle to open the smoker. The legs are of skeleton sheet-metal stamping, with a projecting brace which is very strong and rigid. They are riveted to the stove and bolted to the bellows-board. No matter how rough the usage, these bolts and rivets will not let go. The shield has been omitted, as it has been learned by experience



Three sizes of Root smokers.

not made any more, the Bingham has a very large sale. It has recently been improved by the addition of a detachable curved snout to prevent fire dropping, a safety device (a wire handle) by which the top can be removed for replenishing without burning the fingers, and an arrangement for burning the creosote.

Both smokers employ what is known as the hot-blast principle—that is, the blast of air from the bellows is blown *through* the fire. This makes a heavy volume of smoke—volume enough with the proper fuel to subdue the worst kind of hybrids,

that the cylinder comprising the stove burns out under the shield, destroying the actual life of the metal itself. An anti-spark tube is situated just below this grate, as shown, and of such construction as to prevent the suction of sparks into the bellows or out into the air, setting fire to clothing. The bellows itself is metal-bound (see A), a feature which is greatly appreciated for several reasons. It serves to increase the life of the bellows, protecting the leather edges from wear; prevents absolutely the warping of the bellows-boards themselves, and the binding is of such construction

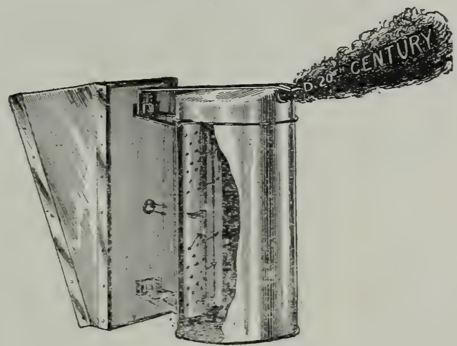
that it forms a very convenient hold to the bellows-boards while the smoker is being operated. This feature makes it possible to reduce the tension of the spring, permitting of a bellows that will respond instantly with a good strong blast, and yet the action is perfectly easy. The hook, C, is for hanging the smoker on a hive or carrying by the little finger when the hands are full of other stuff. There are three sizes of these smokers, comprising stoves 4, 3¼, and 2½ inches in diameter.

Details of the Root smoker.—A.—Metal projection to aid the fingers in holding bellows; B.—Coiled-wire handle; C.—Hook on back of bellows; D.—Stamped metal legs; F.—Flexible hinge.

The object of the curved nozzle on all three of the leading hot-blast smokers is to prevent fire dropping. In the old-style smokers it was necessary in blowing smoke to tip the barrel almost upside down, or at such an angle that fire-embers would sometimes fall on the brood-frames and the bees. The new curved nozzle permits one to use the smoker almost right side up, and yet a stream of smoke can be poured on the combs.

COLD-BLAST SMOKERS.

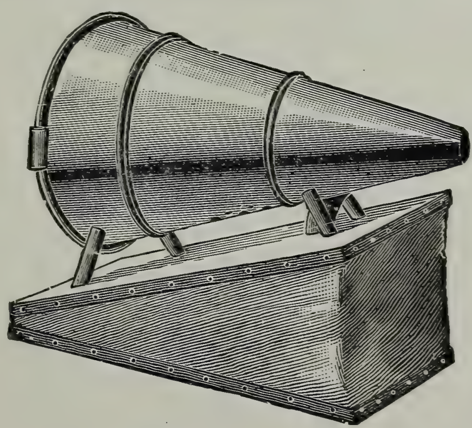
All the foregoing are of the hot-blast type—that is, the blast is forced through the fuel. Cold-blast smokers are constructed somewhat on the principle of an ejector; that is, air is conducted directly from the bellows by means of a tube, to a point inside of the fire-box, *ahead* of the fire, not through it; the result is a blast of cold air charged with smoke. In other words, the blast of air that is forced through the nozzle sucks with it the smoke just back of it, from the burning fuel. This principle was invented almost simultaneously in 1879 by J. G. Corey, of Santa Paula, Cal., and Norman Clark, of Sterling, Ill., each without the knowledge of the other. Of the two smokers, the Clark has the better construction.



Danzenbaker smoker.

In later years Mr. F. Danzenbaker adopted a combination of both hot and cold blast in the form of a vertical grate; but, like the cold blasts, it does not give as dense and subduing smoke as the regular hot blast previously described.

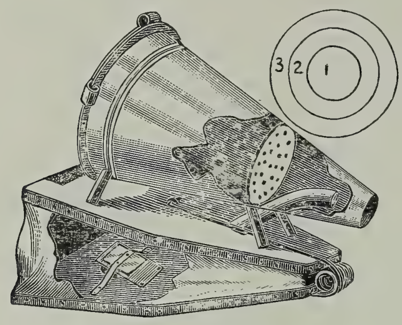
RELATIVE MERITS OF THE HOT AND COLD BLAST SMOKERS.



Clark cold-blast smoker.

For a large volume of dense smoke, the hot-blast smokers are far superior. There was a time when the cold-blast bid fair to run out the hot-blast. The former was thought to have the advantage of being cheaper, using the fuel more slowly, and sending a *cold* blast of air upon the bees. But we doubt if this last feature is an im-

provement after all. Cold-blasts are used principally by beekeepers having few colonies, the more extensive ones finding the hot-blast preferable.



Cold-blast principle illustrated.

One must work the bellows of a cold-blast almost constantly in order to get a smoke dense enough to subdue bees. Even then the force is too strong; while a hot-blast furnishes a gentle breath of strong smoke that will conquer.

FUEL FOR SMOKERS.

It will be unnecessary to give directions for using these hot or cold blast smokers, as printed directions accompany all smokers sent out by each manufacturer; yet it may be well to allude to the different kinds of fuel that have been used. Rotten wood is good, and accessible to all, but it burns out too rapidly. In the Clark we prefer a kind of stringy sawdust packed solid that comes from the hand-holes made in making hives. Mr. Bingham recommends sound hard wood for his smoker. Dr. Miller and some others prefer turning-lathe hard-wood shavings, or, if these are not available, planer shavings. In certain localities peat can be obtained very cheaply, and it makes an excellent fuel. Some use old rags; others old discarded hive-quilts that are covered with propolis. These last make a very pungent subduing smoke. In some parts of the South, dry pine needles are used. One's locality as well as notions will decide what fuel to use.

W. L. Coggshall, one of the most extensive beekeepers in the world, uses a special fuel made out of old phosphate-sacks rolled around a half-inch stick, tied at regular intervals, and then chopped into convenient lengths with a sharp ax. The rolls should, of course, be of the right diameter and length to fit inside the smoker used. The sacking must not be rolled too tightly nor made too snug a fit, or else it will choke the draft and put out the smoker. The

FIG. 2.—Chopping up rolls of burlap for smoker-fuel. An old sack is rolled up, tied at intervals, and then cut in pieces between the strings.

reader is, therefore, recommended to make a few experimental rolls before he makes up a lot for a season's use.

To facilitate lighting with a match, one end of the roll is dipped half an inch into a solution of saltpeter, and allowed to dry. If a little red lead be sprinkled in the solution it will be very easy to tell which end of the roll is for lighting.

A quantity of old sacking, says Mr. Coggshall, will be sufficient for one season's use, and the fuel gives a lasting smoke without sparks. He further says that he can take a cold smoker, and in *ten seconds* have all the smoke he requires, as the saltpeter ignites instantly.

When old sacking can not be obtained, old carpets or old burlap can doubtless be used. Even new burlap would not be expensive, although Mr. Coggshall says the fabric should be partly rotted to give the best results. He lays his old phosphate-sacks out in the weather for about three months, and then rolls them up.

THE BEST SMOKER FUEL.

We have been using greasy waste in a smoker with great success. It requires no treatment with any chemical to make it

extinguish it after it is once lighted, even though it be stamped in the mud. There is no question but that this is perhaps the very best smoker fuel, although in some

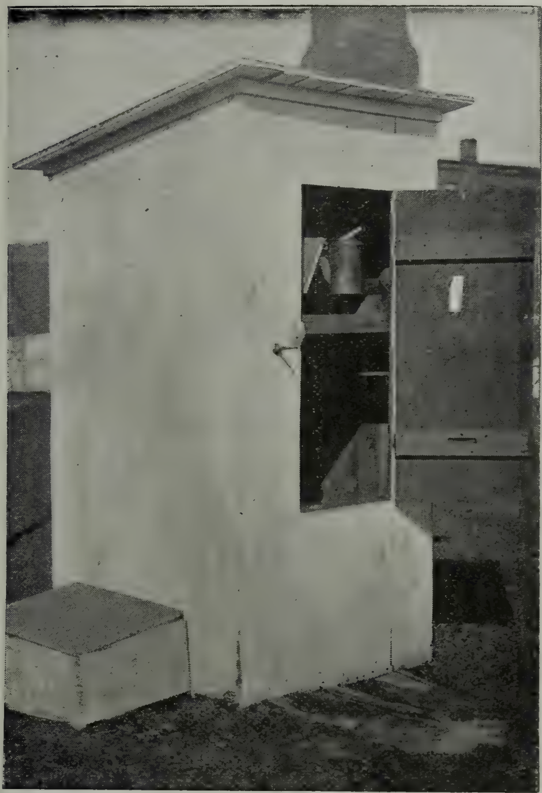


FIG. 3.—A tool-house for smokers, tools, veils, and fuel. The fuel is kept in the lower part under the shelf.

light easily, and it is almost impossible to places it may be somewhat difficult to obtain. It furnishes a strong subduing smoke, and is almost free from creosote. It can usually be had for the asking at any machine-shop or printing-shop, and it may be picked up along railroads, although as a rule it would take too much time to hunt up greasy waste in this way. A piece could be found here and there, but generally not enough to pay for the trouble. A supply can be obtained at a printing establishment to last a whole season; and we always advise its use, therefore, when it can be obtained. It gives a strong, pungent smoke; does not make a hot fire; is easily lighted; will not go out, even though the smoker be left standing for four or five hours at a time.

ABUSES OF A SMOKER.

A good smoker should last a number of seasons, but it will very quickly cease to be a good implement if it is not well taken care of.

One of the most common abuses of a smoker is to leave it out in the rain. We have seen many smokers left out in all kinds of weather; and it is needless to say that the bellows leather soon becomes hard, and cracks,* and the fire-box gets rusty. A good many beekeepers keep their smokers in an empty hive and thus avoid the danger of a costly fire. If the whole hive should burn, the loss would not be so very great.

A better plan than this is to build a small tool-house similar to the one shown. This need not be over five or six feet high. There is a substantial shelf as

Fig. 4.—It is very seldom that a grate becomes so filled up that it has to be cleaned; but when this does happen it is the work of only a monent to insert the point of a file in one of the holes and lift out the grate, as here shown. It pays to keep the grates clean. There are a larger number of holes near the outside of the grate than in the center, consequently the fuel burns evenly and does not throw sparks until it is all consumed.

shown, on which smokers, hive-tools, veils, etc., may be kept. It is a good plan to provide a piece of heavy sheet iron about half an inch above the shelf for the smokers to stand on, so that there will be no danger of setting fire to any thing. The

* Bellows leather should be "dressed." Rub in vaseline or any of the heavy petroleum oils. If the leather has become hard, wet it until it is soft; wipe off excess of water, and at once rub on the oil.—A. C. M.

fuel is kept below this shelf. There is room enough usually to hold a supply for a whole season; and when it is kept in this

Fig. 5.—How to hold the smoker when raising the cap. Compress the bellows in order to give the fingers a firmer hold.

way it is always dry and ready for use. We have such small buildings at all our outyards, and consider them almost indispensable.

Fig. 6.—The convenience of a hook in the back of the bellows. The smoker is always at hand at a second's notice.

Another common abuse of the smoker is to allow creosote to collect at the top until the cap will not fit down over the fire-box. In a new smoker with the flexible hinge there is not apt to be so much trou-

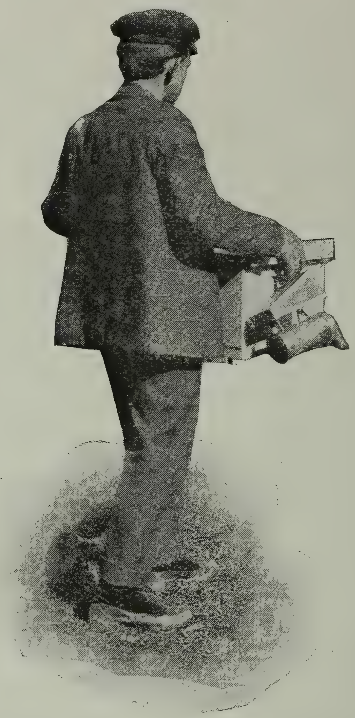


Fig. 7.—Carrying a smoker with the little finger when the hands are full.

ble in this way, but at the same time it is well to spend about ten seconds once a week or so with a screw-driver in cleaning off this accumulation. We have seen smokers with caps or nozzles so filled with creosote that they would not fit down over the fire-box at all, and of course leaked smoke very badly or else had to be pounded on the top with a stick. It takes but little time to remove the greater part of the creosote so that the parts will fit. Most smokers are made with the caps a trifle large; and while they leak smoke at first the collection of creosote will stop this in a short time.

Sometimes beginners in their eagerness to test new smokers work the bellows so vigorously as to blow fire from the nozzle, and before they know it the fire-box is red-hot. This means, of course, that the tin is all burned off, leaving the bare iron to rust through in a short time. There is usually no need of having a hot flame in the fire-box, for this implies perfect combustion; while the secret of getting lots

of smoke is to have imperfect combustion. Sometimes this is a fault of the fuel. It is best to use fuels that burn slowly.

Fig. 8.—Holding a smoker between the knees while manipulating frames.

While it is impossible to avoid dropping a smoker once in a while, still we think as a rule bee-smokers are handled pretty roughly. It does not take long to learn to use reasonable care in handling a smoker, whereby it will last enough longer to pay.

When a fuel is used in which there is a good deal of pitch it is sometimes difficult to raise the cap or nozzle after the fire is out and the metal has become cold. We have known of instances where the cap had been battered almost out of shape after being stuck down solid. It is always best where such fuel is used to raise the cap when putting the smoker away. If it is left open there will be no sticking.

The grate will usually keep clean; but in some cases it might get stopped up, then insert the point of a file into one of the holes and lift it out as shown in Fig. 4. It can then be easily cleaned and replaced.

HOW TO USE A SMOKER.

Perhaps the majority of beekeepers understand using a smoker without any special instructions, but we believe that, as a rule, too much smoke is used. It is best to use just as much smoke as is necessary and not any more. A beginner so often stupefies the bees that they become practically demoralized. It is needless to say that this is a very bad plan. Very often colony after colony can be opened, especially when the bees are working, without the use of smoke; but at the same time it is well to have a smoker near at hand.

It is not considered good practice to smoke bees out of comb-honey supers, as they are frightened at the smell of smoke, and, in their desire to save honey, uncap some of the cells and thus spoil the appearance of what might otherwise be fancy honey.

In looking for a queen, use little or no smoke, as it is very easy to set the bees running all over the combs, making it next to impossible to locate the queen. At such times the frames should be handled slowly and carefully, the beekeeper doing nothing to disturb or excite the bees.

Fig. 5 shows the most natural way of holding the smoker when the cap is opened.

Fig. 9.—Working the bellows of the smoker while holding between the knees manipulating frames.

A better hold is secured with the left hand if the bellows is compressed as shown. Take hold of the coiled-wire handle with the right hand and it will be seen that the cap can be raised very easily without the least danger of burning the fingers. A coiled-wire handle remains cool, no matter how hot the fire is.

SOCIETIES OF BEEKEEPERS.—See ORGANIZATION OF BEEKEEPERS.

SOLAR WAX-EXTRACTOR. — See WAX, also BOTTLING HONEY.

SOURWOOD (*Oxydendrum arboreum* L., DC.).—Also called sourgum and sorrel tree from the acid leaves. A tree growing 60 feet high, belonging to the heath family (*Ericaceae*) with very numerous small white flowers in racemes. The corolla is urn-shaped, closely resembling that of the huckleberry; pendulous, and contracted at the mouth so that the ample supply of nectar is protected both from rain and undesirable insects. It grows in rich woods from Pennsylvania southward to Florida and Louisiana. In Georgia it flourishes chiefly in the northern part of the State, where it blooms in June and July, and is one of the best honey-producers. The honey is medium amber in color, and of excellent quality.

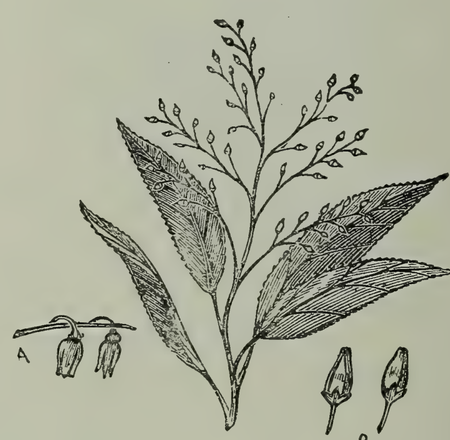
Sourwood is considered a great honey-bearing tree in some localities, especially in the South; but as we have had no personal experience with it, we submit a description from one of our friends who has furnished us with the specimen of the leaves and flowers from which our engraving was made.

The sourwood, sometimes called the sorrel, is a fine tree from 40 to 60 feet in height, and about a foot in diameter; although it sometimes reaches 70 feet in height and a foot and a half through. The popular name, sourwood, is derived from the odors and the peculiar sour taste of the leaves and small twigs.

It is entirely distinct from the black-gum and sour-gum, or pepperidge, with which it has been unwittingly classed by some writers on honey-plants, much to the injury of sourwood. The former are honey-producers to a small extent, but are not worthy to be compared with sourwood, which, we are convinced after living where basswood, poplar, clover, buckwheat, goldenrod, persimmon, and aster abound, has not its superior among the honey-producing plants of America, either in the amount of yield, or in its beautiful appearance. Basswood is more important only because of its widely extended growth. We write this article to call attention more directly to this tree as a honey-producer. Bee-masters are familiar with other flora which abound where those who have written our books on bee culture reside, yet few are aware of the merits of sourwood, outside of the regions where it is found.

We are not familiar with the extent of its growth, but know this much: It abounds in the native forests from southern Pennsylvania into Georgia and Mississippi. It seems to be more abundant along the whole mountainous tract of country on both sides of the Alleghenies and the Blue Ridge, reaching, in places, even as far as the tide-water on one side, and to central Tennessee on the other. In many sections where poplar abounds and much buckwheat is raised, sourwood is considered the *honey-plant*, and yields the largest amount of surplus honey. It seems to flourish best on high, dry soil, and often abounds on poor woodland ridges, which can be purchased at a nominal price; though the forests along the rivers, in rich cultivated soil, are often beautifully checkered with the white blossoms in July. Being a forest tree, it is tall and generally spare of branches along the trunk, except when it grows in the edges of fields, where it yields the greatest amount of honey. The trunk preserves its uniformity of size for some distance up from the ground. The wood is white with straight grain, which splits nicely. It is brittle and quite fine-grained, and is used for posts by cabinet-makers.

The flowers (see engraving) are produced on spikes five or six inches long, which hang in clusters on the ends of branches. Many of these flower-bearing spikes are thrown out from one central spike, and are all strung with white, bell-shaped



Sourwood leaf, flowers, and seed-pods.

flowers, rich in honey. The flower is midway in size and appearance between the whortleberry blossom and the lily of the valley. Unless there is a failure of the blossom, the honey-yield is sure to be abundant; for, being in the woods with good roots, the flow is not checked by ordinary drouths, nor do the rains wash out the honey from the pendant, cup-shaped flowers. Often have we regaled ourselves, while riding along the road, by breaking a bunch of the blossoms, shaking out the honey in the hand, and licking up the delicious nectar. It bears no fruit; but each flower, as it dries up, produces a brown seed-pod about the size of a large grain of wheat, which separates, when ripe, into five parts, and permits the very fine seed to fall to the earth.

We omitted to state that the tree commences to bloom the latter part of June, and the harvest from this source lasts until the middle of July.

We are inclined to think that the tree would thrive in our more northern latitudes; perhaps anywhere in our land. It is found abundantly in many parts of the Allegheny Mountains, where it is verv cold, the thermometer often indicating several degrees below zero.

Liberty Corner, N. J. JAMES W. SHEARER.

SPACING FRAMES.—In nature we find combs variously spaced from 1⅜, 1½, 1⅝, and sometimes up to two inches from center to center. Dzierzon, one of the very first to conceive the idea of a movable comb, gave 1½ as the right distance until Wyprecht made accurate measurements on straw hives having straight combs built in them. Out of 49 measurements, the average distance was scant 1⅜ inches. Baron von Berlepsch, by 40 other measurements, verified this result. In the United States, prominent apiarists have found the distance of natural-built combs averaged 1½ inches from center to center. It has been observed, that, in the center of the brood-nest, the combs are spaced more closely than those on the outside, the latter ranging anywhere from 1⅝ to 2 inches to centers.

It has been urged that we follow nature in the spacing of our brood-frames. But it seems a very poor guide, inasmuch as we find such a diversity of measurements. The beekeeper should adopt that spacing which will give him the best results—the most brood and surplus honey. Quite a number of beekeepers are using 1½ spacing for their frames. The reason for this is, principally, because they happened to *start* with this spacing. But those who have given special attention to the matter, trying *both* spacings, agree almost uniformly that the right distance is 1⅜, or, if any thing, a trifle scant, and some use quite successfully 1¼-inch spacing. Many, indeed, who had self-spacing frames adapted for 1½ inches, have gone to the enormous expense of changing over to 1⅜. The advantages of this latter spacing are so evident that very few deny that better results can be obtained with it. Brood comb is found to be, on an average, ⅞ inch thick; capped brood, one inch thick. On 1⅜ spacing, this will allow ½ inch between uncapped combs and ⅜ between capped brood combs.

The following paragraph is taken from an article published in *Gleanings in Bee Culture,* page 673, Vol. XVIII., written by Mr. Julius Hoffman, inventor of the Hoffman frames, and it applies right here exactly:

If, for instance, we space the combs from center to center so as to measure 1½ instead of 1⅜ inches, then we have an empty space of ⅝ inch between two combs of brood instead of ½, as it ought to be; and it will certainly require more bees to fill and keep warm a ⅝ than a ½ space. In a ½ space, the breeding bees from two combs facing each other will join with their backs, and so close up the space between the two brood-combs; if this space is widened, however, to ⅝, the bees can not do this, and more bees will be required to keep up the needed brooding temperature. What a drawback this would be in cool spring weather, when our colonies are still weak in numbers yet breeding most desirable, can readily be understood.

Where wider spacing is adopted, there is apt to be more honey stored in the combs, and less of worker (but more drone brood). Close spacing, on the contrary (1⅜), tends to encourage the rearing of more worker brood, the exclusion of drone brood, and the storage of less honey below. This is exactly as we wish. We said there is ½ inch between the uncapped brood. The bees need a little more room in backing in and out of the cells for the purpose of feeding the larvæ than they do after these cells are capped over into sealed brood. Sealed brood, requiring less attention from the bees, and less heat from the cluster, is spaced ⅜ apart, and this is ample. For further hints on this subject, see Frames, Self-spacing; Hive-making, Hives, and Honey Comb.

SPANISH NEEDLE (*Bidens aristosa*). —This plant yields immense quantities of honey along the low bottom-grounds of the Mississippi and Illinois Rivers. The following from Gleanings, p. 162, Vol. XVI., is from the Hon. J. M. Hambaugh, and tells all about the plant, and the immense quantities of honey that are often produced by it.

Something over a year ago I wrote a letter for Gleanings, claiming that the honey gathered from this plant is superior to that produced from other fall flowers, and that it should rank among the very best grades, and command the same price in the markets as clover and linden honey. My peculiar location has, fortunately, placed me in a position to understand pretty thoroughly the nature of this plant, and the quality of the honey it produces. Located at the foot of the bluffs of the Illinois River, there is a broad expanse of low marshy lands to the east and south, from three to five miles in width. These lands are subject to overflows from the river once a year, which usually take place in early spring. This renders a large portion of the soil unfit for tilling purposes; and the consequence is, the Spanish needle has secured a permanent foothold, almost to the exclusion of nearly all other plants. Early in September they begin to open their beautiful petal-like rays, and in a short time whole districts are aglow, and their dazzling brilliancy reminds one of burnished sheets of gold. It is now, should the weather prove favorable, that the bees revel in their glory, and the honey comes *piling in;* and the beauty about this kind of honey is, it needs but little "boiling down," and the bees no sooner fill their cells than it is

cured and ready to seal. This is one great advantage, and saves the bees lots of labor, making the storage of honey more rapid. I had one colony of bees that stored 63½ lbs. of honey in six days; another one, 86 lbs. in nine days, while 43 producing colonies netted me 2021 lbs. in ten days—an average of 47 lbs. to the colony. Though not quite as clear as clover or linden, the honey has a golden hue, an exquisite flavor, and a very fine body, weighing fully 12 lbs. to the gallon, and, as previously stated, I can not see why it should not rank on the market in grade and price with clover and linden honey.

SPECIALTY IN BEES.—The question of making beekeeping an exclusive means of livelihood has already been pretty thoroughly discussed under the head of BEGINNING WITH BEES, OUT-APIARIES, PROFITS IN BEES, OVERSTOCKING, and BEES AND POULTRY, especially the latter combination. There are farmers who produce potatoes only. Others grow small fruits; still others, onions or celery. In the line of professions there are physicians who make a specialty of the eyes, some of the ears, and others both of the eyes and ears. Others give their whole time to the treatment of the lungs or the throat, and others to diseases of the skin. While it is true that some beekeepers specialize on queen-rearing and others on extracted honey, the number who confine their attention solely to the keeping of bees is very small. As a general proposition, beekeeping is too uncertain in the average locality to make it a sole means of livelihood.

Whether one shall keep more bees and drop all other pursuits will depend on a good many conditions. First and foremost is the question of locality; second, the man; third, the state of his finances.

LOCALITY.

No one should attempt to make a living entirely from bees unless he has a locality that is capable of supporting a large number of bees. See LOCALITY and OVERSTOCKING. In some places, probably not more than twenty-five or fifty colonies could be maintained to a yard. Two hundred parceled out in five or ten apiaries two miles apart would increase the expense of operation. To put a man at each yard would be out of the question. A horse and wagon would be too slow, because the apiarist would thus be one-third of the time on the road. An automobile truck is expensive. If one has a locality that will support five hundred to a thousand colonies in from ten to twenty yards, the gross earnings would warrant the purchase of an automobile truck and a runabout, perhaps, for making quick trips. As a rule, a few bees as a side line can be kept profitably almost anywhere; and therefore if one has a notion of making beekeeping an exclusive business he should seek some locality where there is an abundance of flora capable of furnishing a good table honey that will bring a good price, and a locality which, at the same time, is not already occupied by other beekeepers, thus overstocking. See OVERSTOCKING.

THE QUESTION OF THE MAN.

Some men who do well with a small business would make a failure with a large one. Going into beekeeping extensively not only requires capital and brains but a large amount of business ability. With the element of business ability comes the question of experience. Certainly no one should engage in the bee business in an extensive way unless he has had a large amount of practical knowledge of a kind that starts from the bottom and works upward. See BEGINNING WITH BEES. A large business gradually built up from a small beginning is much more sure of success, especially if the man who made the start is still the presiding genius of the large business. While one can sometimes buy a man of successful experience, it is better for the boss to have the *know how* himself; otherwise, if his man leaves him for any cause he would be sadly crippled. Moreover, if he knows the business himself, his help can not impose on him by pretending to "know it all."

CAPITAL.

Capital is another important requisite. This need not, however, be a serious obstacle if one would be willing to start with a small beginning and make the bees pay their own way, as we have taught all through this work. See BEGINNING WITH BEES. Indeed, one would be much more likely to meet with success if he gradually enlarges his business, bearing in mind the danger of trying to expand too fast.

SPECIALIST BEEKEEPERS; WHERE LOCATED.

The number of persons who make beekeeping a specialty is constantly increasing; but most of the specialist beekeepers are located west of the Mississippi. Where

alfalfa is grown extensively we often find beekeepers who number their colonies by the thousand. The mountain-sage districts of California sometimes makes specialized beekeeping a possibility. As a general proposition, however, we may state that where there is one specialist beekeeper there are a thousand who combine the business of honey production with some other profession or business.

SPECIFIC GRAVITY OF HONEY.—Ordinary extracted honey when ready for the market should run about 12 lbs. to the gallon at normal temperature. If, however, it is heated to 135 or 140 Fahr., to prevent granulation (see GRANULATION OF HONEY), the specific gravity while at this temperature will be about 11 lbs. 10 oz. to the gallon. As the average gallon can will not hold 12 lbs. of honey at a temperature sufficiently high to prevent granulation, the consumer will not get a gallon of honey.

There are some honeys that run about 11½ lbs. to the gallon, but they should never be put in sealed cans nor marketed when as thin as that, as they are almost sure to sour. They should rather be stored in open vats or cans in a dry room for a few weeks, so that the excess of moisture can escape. Honey exposed in a damp atmosphere will take on more moisture. It is, therefore, important that the artificial ripening process take place in a warm *dry* room, heated artificially if necessary. As a rule it is not wise to extract honey in the Eastern States unless three-fourths of all the cells are capped over; and sometimes *then* the honey should be left on the hive until all the cells are sealed. In the Western States where there is a drier atmosphere, or during extremely hot dry weather in the East, a larger percentage of unsealed cells may be permissible at the time the combs are extracted; but it is best to store in open cans for a short time before shipping.

When honey is not thoroughly ripened—that is to say, when it runs a little short of 12 lbs. to the gallon, the thinner portion is apt to rise to the top while the heavier part will settle to the bottom (see EXTRACTED HONEY). The top will have a tendency to sour, and it will not be long before the whole mass will be involved. If the souring or fermenting process has not gone too far, the honey may be saved by heating, thus destroying the yeast plant. But if it has gone too far, nothing can be done but convert the honey into vinegar. See VINEGAR.

SPRAYING FRUIT-TREES.—See FRUIT-BLOSSOMS.

SPRAYING DESTRUCTIVE TO THE BROOD.—See FRUIT-BLOSSOMS.

SPREADING BROOD.—As is very well known, queens are inclined to lay their eggs in circles in the comb, the circle being larger in the center combs and smaller in the outside ones. The whole bulk of eggs and brood in several combs thus forms practically a sphere which the bees are able to cover and keep warm. When the queen has formed this sphere of brood and eggs she curtails her egg-laying for the time being until enough brood is hatched out to increase the size of the cluster; and then she will gradually enlarge the circles of brood to keep pace with the enlarged ball of bees.

Yet the queen very often is overcareful—that is, she errs on the safe side, so that when warm weather has fully set in she sometimes lays fewer eggs than she should in the judgment of the apiarist, and accordingly he inserts a frame of empty comb in the center of the brood-nest. In this comb the queen will commence laying at once* to unite, as it were, the two halves of brood: and when she has filled this with eggs the apiarist may insert another empty comb. If the queen has filled the first one given she will be likely, if the weather is not cold, to go into the second comb and fill it with eggs on both sides; for nice clean empty cells are very tempting to her. In a word, this operation of inserting empty combs in the center of the brood-nest is called "spreading brood," its object being to increase the amount of brood, and thus insure a larger force of workers for the prospective harvest. While this spreading of the brood *may* be done by practical and experienced beekeepers, because it stimulates the queen to greater egg-laying capacity, yet when practiced by

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* Sometimes she does not, and then there is a permanent separation of the brood and a serious loss. To "insert another empty comb" as soon as the first is filled with eggs will, nine times in ten, lessen the brood.—C. C. M.

beginners and the inexperienced it generally results in much more harm than good. An A B C scholar without previous experience might, on a warm day in early spring, think it high time to put empty comb in the center of the brood-nest. The queen, we shall say, immediately occupies it, filling it with eggs. This, of course, requires a large force of nurse-bees to take care of the young bees and hatching larvæ. A cool spell of weather is almost sure to come on, with the result that the cluster of bees is contracted, leaving the brood that was forced outside, out in the cold, where it chills and dies. The outside edge of the cluster, in its effort to take care of this brood,* is likewise chilled, with the result that the colony suffers a check and setback far worse than had it been left to its own devices.

Ordinarily we may say that the spreading of brood can be practiced safely only after settled warm weather has arrived. The beginner who desires to give extra combs for egg-laying, especially in early spring, would do well to put those extra combs at the *outside;* but after settled warm weather has come, when the temperature does not go below 50 degrees Fahrenheit at night at any time, he may insert a frame of empty comb at the center of the brood-nest.

It should be borne in mind that the practice of spreading brood has been largely abandoned, even by experienced beekeepers. Where the queen has plenty of room somewhere in the brood-nest (and that "somewhere" should be outside the brood-cluster), both bees and queen will ordinarily rear as much brood as they can safely and profitably care for.

SPRING DWINDLING.—This is confined to bees outdoors or those just set out of the cellar, and appears only in spring—hence the name. It was once supposed to be a disease; but it has now been definitely determined to be only the natural result of a severe winter on a colony too weak or a normal one not protected to stand the cold. Gradually the individual members die off until the original bunch of bees is reduced to a few dozens. This gradual decimation may be due to a low vitality on the part of the old bees that are inclined to die off any way before spring, or it may be due to dysentery. See DYSENTERY. If it is caused by the first mentioned, it shows that the colony went into winter quarters with almost no *young* bees; that is to say, the great force representing the colony was made up of *old* bees whose length of days would naturally expire at the beginning of the spring, even under good or the best conditions; when, therefore, the conditions are *not* favorable, naturally enough these old bees die off much the sooner.

On the other hand, if spring dwindling is due to dysentery, the condition of the colony in the fall previous, if it could be known, would probably show an insufficient protection, or a cluster too weak in the first place to stand even an *ordinary* winter, to say nothing of one that is exceptionally cold. Under DYSENTERY, we show that this disease or malady, rather, is the result of overfeeding. Overfeeding is caused by an attempt on the part of the bees to keep themselves warm. A cluster too small, or a normal cluster in a single-walled hive, in a cold climate, will overeat; and as the bees have no opportunity for flight, their intestines become overcharged, resulting finally in purging, and this purging fouls up the whole hive. An examination down in the brood-nest at about this stage in the spring shows a small weakened cluster, bees uneasy and somewhat scattered, and combs emitting a nasty ill-smelling odor of excrement. The bees have greatly distended abdomens, showing that they are overloaded with fecal matter, as explained under DYSENTERY. A normal colony should show a compact quiet cluster of bees.

A good flight in warm weather will enable diseased bees to cleanse themselves and make a new start. In fact, continuous warm weather is a relief for spring dwindling. But, unfortunately, in many localities there will come a week or two of warm weather at which time bees will start brood-rearing. When a cold spell comes on, the already greatly attenuated force attempts to hover its brood, with the result that both brood and bees die. A changeable condition of weather, therefore, is hard on nuclei that are suffering from spring dwindling.

* The bees draw into a closer cluster to keep themselves warm. Some cluster on the outlying brood because it is warm. As the temperature falls the brood and its thin layer of bees gradually lose their heat, and all chill and die together.—A. C. M.

In this connection, spring dwindling caused by dysentery may be due to bad food; but in most cases it is caused by insufficient housing—that is, a lack of proper packing. See SPRING MANAGEMENT.

REMEDY FOR SPRING DWINDLING.

Sometimes several of the nuclei that have been reduced by spring dwindling may be united; but in most cases this does little or no good. While the combined force of bees all in one hive look well at the time of uniting, yet in a few days, apparently, this large force seems to have diminished very rapidly, and, unfortunately, it is no better so far as strength or appearance is concerned than any one of the several nuclei that went to compose it in the first place.

Probably the best way to unite is on the Alexander plan, as given under the head of UNITING. If practiced early it will prevent spring dwindling.

As a further prevention colonies should be made to rear brood as late in the fall as possible. If there is any fall flow, bees will rear brood naturally, and the hives will be filled with a large force of young bees. If there is no fall flow, stimulation should be practiced. See FEEDING. This stimulative feeding may not start up brood-rearing if the queens are two or three years old. As a rule it does not pay to keep queens longer than two years; and many think that they should not be older than one year. Young queens will lay readily in the fall if given stimulative feeding, while old queens may require considerable coaxing. It follows that one of the best preventions for spring dwindling is a young queen in the fall. Such queens will lay until a large amount of stores is used up in August and September, in the northern States, and the beekeeper should, therefore, see to it that they have sufficient after they cease brood-rearing. And this brings up another important matter; and that is, there is nothing better than good sugar stores for the prevention of spring dwindling or dysentery; and these should by all means be given in the *fall* early enough to be sealed over, rather than in the *spring*.

For particulars on how to protect the colonies to avoid spring dwindling, see SPRING MANAGEMENT and WINTERING. For the causes that induce dysentery in colonies that spring dwindle, see DYSENTERY. For particulars on how to feed in the fall, see FEEDING. For the consideration of the question of uniting, see the Alexander method under the head of UNITING.

SPRING MANAGEMENT.—All colonies should be gone over very carefully as soon as bees can fly, three days in a week, say. Unless they have two or three combs of honey, stores should be taken from some other colonies that can spare them. If no hive has a surplus, then the needy should be fed a thick syrup consisting of two parts of sugar to one of water. See FEEDING, especially those instructions urging fall rather than spring feeding.

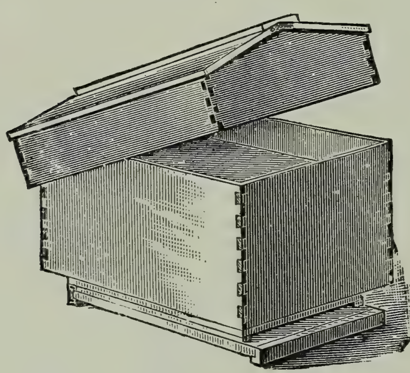
Feeders should be placed on top of the frames, and covered with packing. It may turn cold shortly after; and even if the syrup is left in the feeder, starvation will be averted, for the bees will cluster around it and help themselves as they have need. When the weather is cool or cold the syrup should be given hot.

If colonies have been well housed and fed in the fall, there will usually be no occasion for feeding or equalizing of stores. Of course, there is liable to be here and there a colony which, by reason of bad stores, may have dysentery. In that case the front of the hive will be soiled with dark brown spots, and there will be a quantity of dead bees in front of the entrance and on the bottom of the hive. Such a colony, even with the best of nursing, may die before settled warm weather comes on. If considerable honey-dew has been gathered during the previous summer, one is likely to find some spring dwindling and dysentery in some of the hives. Some honey-dews will make a very fair winter food; but the majority of them, especially those gathered from hickory and oak, are bad. Where this is gathered, we would endeavor to use as much of it as possible in brood-rearing in the summer, and then feed sugar syrup.

Some springs the weather will open up warm very suddenly with no natural pollen available. The warm weather may last several days. During this time brood-rearing will start up rapidly; and if there is no pollen in the hives the bees will be hunting around in the barns and stables and chicken-coops for bran or chopped

feed. It is necessary at such times to give artificial pollen. Trays should be set out in sunny places, under cover if possible, containing a few quarts of rye or pea flour.

Unless bees can have natural or artificial pollen when brood-rearing starts, considerable brood will be found dead. On seeing this the beginner is apt to conclude he has some form of bee disease—possibly foul brood. If the brood dies shortly after a sudden warming-up spell, during which there is very little natural pollen in or out of the hives, the owner of the bees should await further developments. See the last paragraph of the general subject of POLLEN and FOUL BROOD for further particulars.



Outer case used for spring protection.

It may be necessary in some climates, after the bees are set out of the cellar on their summer stands, to provide some sort of protection. Some use wooden winter cases, and others use paper folded over the hives as shown further on under the head of wintering.

Where colonies are very weak it may be advisable to unite; but this uniting, if the bees are in the cellar, should take place before they are set out. See UNITING.

One difficulty in uniting outdoor bees is that those moved to a new stand are quite inclined to go back to the old hive. This can be overcome to a large extent. See UNITING. Uniting in the spring is often unsatisfactory. Never unite two weak ones, but add a weak one to a medium, and thus make it strong. Unless the colony is very weak we advise taking out the surplus of combs that they do not occupy or use, and crowd the little cluster on as few frames as they can occupy. In that case, division-boards should be moved over, and the frames set over on the other side. The hive should be warmly packed, and the entrance contracted down to one inch wide to prevent robbing and to conserve the heat.

In going over the yard in early spring one is likely to find, if the bees are wintered outdoors, one or more dead colonies. Their entrances should be shut up bee-tight, for on the first warm fly day they will be robbed out by the other bees, resulting in a general disturbance of the whole yard. See ROBBING. Combs on which bees have died may be used later on by putting fresh bees on them. Unless they are very badly soiled with dysentery so they are fairly smeared over with a brown excrement, or the stores are very bad, they can be used again. But badly soiled combs, or otherwise undesirable, should be put through the wax-extractor. See WAX; also DYSENTERY.

In early spring it may be necessary to rake out the dead bees in the entrances of some colonies. If a colony is strong it will usually do its own house-cleaning; but sometimes the dead accumulate in such numbers as actually to block the entrance. In all such cases there is danger that the few survivors may die outright.

Some very weak colonies will be found with queens, while there will be some other colonies fairly strong without any queen. In that case it is best to unite these two, moving the weak colony over to the strong one. See UNITING; also INTRODUCING.

Some experienced beekeepers can "spread brood" in early spring; but the beginner will do well not to practice it. See SPREADING BROOD.

WHAT TO DO WITH COMBS FROM HIVES WHERE THE BEES HAVE DIED.

Put them safely out of the way of the bees, either in tight hives or in a bee-proof room; and if you have not bees enough to cover them by the middle of June, or at such a time as you shall find moth-worms at work among them, be sure that all the combs are spread at least two inches apart, as recommended under BEE-MOTH. Now, whatever other precautions you take, you *must* look after these empty combs occasionally. They are very valuable, and should not be allowed to be destroyed. A very good way is to keep them in regular

hives, piled one over the other. This keeps them perfectly protected, and yet you can quickly look them all over as often as once a week at least, until they are used.

STATISTICS CONCERNING THE BEE AND HONEY BUSINESS.—It is regretable that there are no accurate figures concerning the number of beekeepers and number of colonies of bees in the whole United States. While the census reports beekeeping among other industries of the country, yet an examination of the figures for 1900 and 1910 show that they should not be taken too seriously. They may be accurate for some individual States, but it is nevertheless a fact that they are very inaccurate for other States. Attention to this will be called a little later.

But why should we not take the census bureau figures too seriously? In some States at least it is apparent that the census enumerators were much more careful in gathering their data than in others. Take a case in point. In 1900 the United States census figures showed that one of the States in the Union, namely, North Carolina, where beekeeping is a comparatively neglected industry, was actually reporting more bees and more honey than the great State of California, where we *positively know* there is more honey produced than in almost any State in the Union, in a good season at least. The explanation of this is doubtless due to the fact that the census enumerators for North Carolina were careful to get in their record every beekeeper and every farm where bees were kept, while the more important State of California, where beekeeping is a large and flourishing industry, the census enumerators did their work very poorly. Many of the largest bee ranches in the United States are located up in the mountains in the sage district of California. The enumerators probably did not get track of these. In a general way, we may say in this connection that many of the most extensive beekeepers of the world are located in out-of-the-way districts apart from the general public, and for that reason the enumerators probably failed to get any record of them. But in these out-of-the-way districts sometimes honey is produced by carloads. We should therefore judge that the census people did not get any record of some of the largest bee ranches in the world.

Again, it is well to call attention to the fact that the census for both 1900 and 1910 take into account only bees on farms. There are a very large number of people who keep bees, that are located in the towns and cities, and some of these are quite extensive producers of honey. Attention will be called to this later.

Let us take another case in point that shows the United States census is not to be taken very seriously. At one of our principal State beekeepers' conventions it was found that approximately three-fourths of the bees there represented had not been included in the 1910 census account. A similar condition has been found in other conventions, and if this is true it is no small wonder that the United States census does not adequately represent the bee and honey industry in the United States.

It is to be hoped that ere another ten years rolls by the U. S. Census Bureau will appreciate the importance of the beekeeping industry and will see to it that its employees or enumerators in *every State alike* take as much pains in getting data concerning bees and honey as they do of the other larger industries in the country. Unfortunately, the census people appear to have had the impression that the keeping of bees is a very small industry, and hardly worth taking any account of. It is high time they knew that there are millions in the business.

Fortunately, the authors of this work are in possession of data showing the amount of the beekeepers' supplies sold throughout the United States, and this data enables us to form a fairly accurate idea of the relative importance of the industry. When therefore we find that the United States census figures are very much at variance with our data, we know there must be some mistake somewhere, and this mistake is due rather to the manner in which Uncle Sam has secured his figures.

Knowing that the census figures for 1900 were grossly inaccurate, all the manufacturers of beekeepers' supplies in the United States agreed to turn over their complete output of sections to Dr. C. C. Miller, of Marengo, Illinois. As there would be necesarily some rivalry and jealousy between the various manufacturers, it was agreed

on the part of all that the relative output of each factory would be kept entirely secret, and that only the total or gross aggregate should be given out to the public. The figures were duly turned over to Dr. Miller, and he subsequently made public the total aggregate, showing that there is annually manufactured in the United States sixty million section honey-boxes. As these figures were based upon an average taken from a period of years, the actual annual output of sections as here given is fairly accurate. As each honey-box holds slightly less than a pound on the average, it is fair to assume that the actual yearly output of comb honey in the United States is somewhere around fifty million pounds. So much for comb honey.

At the time these figures were taken by Dr. Miller it was generally estimated that there was three times as much extracted honey as comb, but at the present time it would be conservative to say that there is at least five times as much. If we use the multiple of three, the total amount of extracted honey would be one hundred and fifty million pounds of this product; or if we used the multiple of five, the total would be two hundred and fifty million pounds. But let us take the lower figure and consider that the actual amount of extracted honey produced in any one year is one hundred and fifty million pounds. To this should be added the fifty million pounds of comb honey, making a total of two hundred million pounds.

Extracted honey sells anywhere from five to ten cents per pound, and comb anywhere from ten to thirty cents per pound. But let us take the conservative figure of ten cents as an average price that honey sells for, both comb and extracted. This would make twenty million dollars' worth of honey that is annually produced in the United States in any single year. As the average lay mind can not comprehend these figures we will load these two hundred million pounds of honey into freight cars of thirty thousand pounds to a forty-foot car. Now, let us put all these cars together into one solid train and we find we will have a train fifty miles long. The average person when he comes to consider these figures, especially when it is loaded into freight cars like this, thinks there must be some mistake, and that it can not be possible that any amount of honey like that was produced in the United States alone. Even if we accept the United States census figures (which we are satisfied take into account only about half the amount of honey produced in the United States) we will still have as the annual production ten million dollars' worth of honey. Considering the fact that the census enumerators skip large areas, and in many cases omitted to take into account the product from extensive apiaries located in out-of-the-way districts, nor yet the large number of bees located in towns and cities, it is fair to assume that our own figures of twenty million dollars' worth of honey annually produced in the United States are much more accurate than those given us by Uncle Sam.

Now the question arises, how many colonies of bees are there, and how many beekeepers in the United States. If we estimate for convenience that the average output per hive each year, taking one year with another, is somewhere about twenty pounds; if we accept the figures of two hundred million pounds as the total aggregate production in the United States, we would have in the neighborhood of about ten million colonies of bees. If we estimate that each beekeeper in the country has on the average about ten colonies, we would then have a million beekeepers in the United States. The United States census shows that there were nearly six hundred thousand farms reporting bees in 1910, and seven hundred thousand in 1900, showing a falling-off of one hundred thousand during the ten years. Attention will be called to this later. As these figures do not take into account the large number of persons keeping bees in cities and towns, many of whom produce honey by the carload, it is safe to estimate that the total number of persons keeping bees in the United States is somewhere around one million, or the same number arrived at by the other calculation based on the total aggregate of honey produced in the country.

Thirty or forty years ago, most of the honey in the United States was produced east of the Mississippi from clover. In many parts of this section of the country the pasture lands have given away to intensive agriculture, and while it is no doubt true that more clover honey is produced now east of the Mississippi than during

an earlier time, because there are more bees, yet it is safe to say that the clover area is becoming less and less. However, this reduction in white clover is being offset to a great extent by the sowing of alsike clover on farms where red clover grows only sparingly. See CLOVER. In the mean time, irrigation has opened immense tracts where alfalfa is being grown, so that at the present time most of the honey being produced in the United States comes from the country west of the Mississippi. At all events, the markets are better supplied with mountain sage and alfalfa than they are with clover honey. Over against this we must take into consideration that the great centers of population are east of the Mississippi, and the probabilities are that most of the clover honey produced in that part of the country is consumed locally. In the West the country is much more sparsely settled, but, on the other hand, beekeeping is carried on in a much more extensive way. The result is that the West produces more than it can consume, and it is shipped eastward. Still, even when we take all these factors into consideration the fact remains that the great bulk of the honey comes from the West. F r example, in a good year California would doubtless lead off. Indeed, there has actually been shipped out of that State after a good season as high as five hundred cars of honey. This does not take into account the large consumption of honey within the State. Texas would follow as a close second. Then we would place next in order Colorado, Arizona, New Mexico, and, in general, those States where alfalfa is grown very largely. According to the United States census figures which we will reproduce shortly, Missouri and Illinois follow very closely after the two great States of Texas and California in the matter of honey production. This may or may not be true; but if Illinois, Missouri, New York, and Pennsylvania produce as much honey as is credited to them by the census, there are certain other States with conditions practically as good that should produce almost as much. But a comparison of the table shows in most cases that they are away below. If the census enumerators did their work as faithfully in these States where the showing is light, as was done in Illinois, Missouri, New York, and Pennsylvania, then it would show that the poor States mentioned were much better. But the facts are that the soil, conditions, climate, and all are about the same in a number of the States, and there should not be such a difference as we find between Kansas and Missouri, for example, or between Minnesota and Wisconsin, or Minnesota and Illinois.

In respect to the amount of beeswax annually produced in the United States, the Bureau of Entomology has estimated that there is about two million dollars' worth, or about one-tenth of the value of honey annually produced in the country. But beeswax sells anywhere from 25 to 30 cents per pound, and that is two and a half or three times as much as honey brings, if we figure 10 cents as the average price of both comb and extracted. On this basis, for every pound of wax produced there would be from 25 to 30 lbs. of honey; and this proportion would not be far from correct. The presumption is that the census enumerators were more careful to get the exact account of the amount of beeswax on hand at the farms because of its larger relative value.

A little way back we referred to the fact that the United States census for 1910 should not be taken too seriously; but it should be said that it is valuable for the purpose of comparison, as both were taken by the same method. We herewith present a comparative table of the census for 1900 and 1910. The student will be interested in comparing the figures. For instance, there has been a marked falling off in the number of farms where bees were reported. That there has been a decrease in the number of farmer beekeepers there can be no question. Whether the table showing the decrease by States is accurate, we can not say; but decrease there surely has been in the aggregate. This is probably due to two causes; viz., 1. To a reduction in the amount of clover grown, either because intensive agriculture has crowded it out, or because soil that once grew clover luxuriantly has become "clover-sick"—that is, too acid. Clover is the main dependence for honey in most of the States east of the Mississippi and north of the Ohio. It is a notable fact that clover doesn't yield as it did in the olden days before the lime had been exhausted from the soil. See CLOVER.

When "bees don't pay" on the farm, they die off because the farmers won't feed them. We shall have more to say about this at a later time. 2. The other cause for reduction in the number of farmer beekeepers is clearly traceable to bee disease that has made such rapid spread. The obvious remedy is to work for more extensive bee-inspection work and, besides, preach the doctrine of putting lime in the soil. That can be done cheaply, and make clover grow as before. While lime can have no effect on bee diseases it will make clover grow as it did in old days.

Attention should be called to the fact already mentioned, that these data are for bees on farms only, and that bees in towns and cities are not included. The official designation of a "farm" actually includes many apiaries in towns; but, as is well recognized, most of the large town apiaries have not been included in the enumeration.

The only States showing any *increase* in beekeepers worthy of consideration are Minnesota, Oklahoma, South Dakota, Washington, Montana, Wyoming, and North Dakota—all western States. The greatest reported loss is Utah, where 49.5 per cent decrease is shown in the number of farms reporting bees. It is worthy of mention that the loss in number of farms reporting bees is usually greater than the number of colonies, indicating that those now in the business are keeping more bees. On account of bee diseases already mentioned, farms that used to keep bees in a small way have now been obliged to give up the business because bee disease will not allow bees to work for nothing and board themselves as they used to do in the olden

State	Farms reporting bees in 1910	Farms reporting bees in 1900	Per cent of gain or loss	Colonies reported in 1910	Colonies reported in 1900	Per cent of gain or loss	Value in dollars 1910	Value in dollars 1900	Per cent of gain or loss
Alabama	23,911	32,100	—25.5	135,140	205,269	—34.2	213,000	288,000	—26.0
Arizona	441	489	— 9.8	23,770	18,991	† 25.2	104,000	66,600	† 56.7
Arkansas	19,692	22,182	—11.2	92,731	111,138	† 16.6	200,000	204,000	† 2.1
California	6,869	6,915	— 0.7	200,718	129,444	† 55.1	728,000	364,000	†100.1
Colorado	3,563	4,518	—21.1	71,434	59,756	† 19.5	309,000	195,000	† 58.5
Connecticut	1,798	2,252	—20.2	9,445	11,438	—17.4	41,800	40,500	† 3.2
Delaware	1,119	1,684	—33.6	6,410	10,187	—37.1	13,600	20,244	—32.8
District of Columbia	13	7	† 85.7	151	59	†155.9	790	199	†297.0
Florida	4,345	4,521	— 3.9	38,895	39,753	— 2.2	98,500	83,800	† 17.5
Georgia	23,167	32,246	—28.2	130,549	187,919	—30.5	187,000	243,000	—22.9
Idaho	2,368	2,387	— 0.8	21,903	19,240	† 13.8	100,000	65,000	† 54.1
Illinois	29,741	34,932	—14.9	155,846	179,953	—13.4	487,700	486,200	† 0.3
Indiana	19,487	28,632	—31.9	80,938	117,148	—30.9	230,500	278,900	—17.4
Iowa	28,935	28,977	— 0.1	160,025	138,811	† 15.3	517,300	443,900	† 16.5
Kansas	16,869	18,295	— 7.8	73,737	88,594	—16.8	218,600	278,000	—21.4
Kentucky	36,854	44,974	—18.1	152,992	203,820	—24.9	419,000	527,000	—20.4
Louisiana	4,928	6,148	—19.8	29,591	35,231	—16.0	58,200	54,300	† 7.1
Maine	1.371	2,496	—45.1	7,592	10,857	—30.1	30,400	51,500	—21.0
Maryland	4,186	5,098	—17.9	23,156	28,013	—17.3	61,600	61,000	† 1.0
Massachusetts	1,597	1,799	—11.2	7,464	8,381	—10.9	39,700	35,800	† 11.0
Michigan	16,892	18,122	— 6.8	115,274	100,397	† 14.8	446,500	352,500	† 26.7
Minnesota	9,522	6,078	† 56.7	56,677	45,877	† 23.5	221,800	167,300	† 32.6
Mississippi	16,028	17,990	—10.9	74,350	95,257	—21.9	144,000	159,000	— 9.1
Missouri	40,110	41,145	— 2.5	203,569	205,110	— 0.8	585,000	508,000	† 15.0
Montana	795	234	†239.7	6,313	1,801	†250.5	32,100	8,100	†294.5
Nebraska	12,538	12,130	† 3.4	45,625	52,143	—12.5	153,000	200,000	—23.5
Nevada	176	278	—36.7	8,401	5,692	† 47.6	48,500	20,100	†140.7
New Hampshire	1,002	1,288	—22.2	4,644	5,520	—15.9	23,600	24,700	— 4.3
New Mexico	418	410	† 2.0	10,052	6,164	† 63.1	46,300	20,800	†122.6
New Jersey	1,627	2,327	—30.1	10,484	14,118	—25.7	41,600	39,200	† 6.0
New York	15,279	22,738	—32.9	156,360	187,208	—16.5	647,000	594,000	† 8.9
North Carolina	36,258	41,051	—11.7	188,998	244,539	—22.7	387,000	430,000	—10.1
North Dakota	79	30	†163.3	495	279	† 77.4	3,086	1,474	†109.4
Ohio	23,203	34,458	—32.7	98,241	151,391	—35.1	276,000	403,000	—31.5
Oklahoma	4,816	3,438	† 40.1	19,411	20,137	— 3.7	64,300	45,400	† 41.5
Oregon	8,861	8,895	— 0.4	47,285	55,585	—14.9	150,000	160,000	— 6.4
Pennsylvania	22,297	28,962	—23.0	124,830	161,670	—22.8	478,000	532,000	—10.0
Rhode Island	285	370	—23.0	1,267	1,681	—24.6	6,100	6,800	— 9.7
South Carolina	12,528	16,272	—23.0	75.422	93,958	—19.7	135,000	143,000	— 5.6
South Dakota	1,347	387	†248.1	6,553	2,063	†217.6	31,600	10,100	†213.1
Tennessee	30,712	38,225	—19.7	144,479	222,788	—36.0	341,000	487,000	—30.0
Texas	37,875	60,043	—36.9	238,107	392,644	—39.4	675,000	749.000	— 9.9
Utah	1,873	3,037	—49.5	26,185	33,818	—22.6	123,600	111,500	† 10.9
Vermont	1,124	1,878	—40.2	10,215	12,836	—20.4	44,300	47,000	— 5.5
Virginia	22,437	25,774	—12.8	104,005	139,064	—25.2	303,000	308,000	— 1.9
Washington	5,886	4,435	† 32.7	33,884	30,870	† 9.8	127,000	107,000	† 18.8
West Virginia	24,035	25,240	— 4.8	110,673	111,417	— 0.7	388,900	375,600	† 3.5
Wisconsin	10,391	10,535	— 1.4	95,638	106,090	— 9.9	360,500	377,000	— 4.4
Wyoming	579	153	†278.4	4,596	1,020	†350.6	20,493	5,322	†285.1
Grand total	590,907	707,315		3,462,520	4,258,239		$10,372,978	$10,179,839	

A dash (—) before a number indicates a loss; † shows a gain.

days. The result is now that there is a smaller number of beekeepers in the country perhaps, but a larger number of colonies of bees. In some of the western States there are not a few beekeepers who count their colonies by the thousand and who produce honey by the carload.

Taking everything into consideration, the beekeeping industry is certainly growing. The bee-supply factories all over the country show a healthy increase; and the business of selling honey is being organized and developed now as it never was before. While there are fewer bee journals in the United States than there were ten years ago, yet these bee journals are of a much higher class with a much larger circulation. This would indicate a larger interest in bees, not on the part of everybody, but on the part of those who are making the business more of a study.

STINGLESS BEES.—See Bees, Stingless.

STINGS.—It is true, that bees can not bite and kick like horses, nor can they hook like cattle; yet most people, after having had an experience with bee-stings for the first time, are inclined to think they would rather be bitten, kicked, and hooked, all together, than to take the risk of a repetition of that keen and exquisite anguish which one feels as he receives the full contents of the poison-bag from an enraged bee during the height of the honey season. Stings are not all alike, by any means, and something depends on where they strike; and while we can stand the greater part of them without even wincing, or stopping our work, we once in a great while get one that seems as if it could not possibly be borne.

The pain is much harder to bear if we stop to allow our minds to dwell on it; or after being stung, if we just think of former times when we received painful stings, at the mere thought a sudden pang darts along the wounded part. We do not know why this is, unless it is the effect of the imagination; if so, then it is clear that even imaginary pains are very hard to bear. We have sometimes purposely, by way of experiment, allowed the mind to dwell on the pain of the sting the very moment that it was inflicted, and the increase would be such that it would almost make one scream with pain. If you doubt this, the next time your feet get very cold, just think of wading barefooted in the snow, at a zero temperature.

Of course, where stings swell on one so badly as to shut an eye, or the like of that, one possibly might be obliged to stop work awhile; but even then, it would be advisable to pay as little attention to the matter as possible, and by all means avoid rubbing or irritating the affected part. We have known stings to be made very painful by rubbing and fussing with them which

Effect of one bee-sting on the lip of a novice.

we have good reason to think would have given little if any trouble otherwise. You all know that, when you get warmed up with hard work, a bruise, a bump, or a slight flesh wound, gives little if any pain; but to sit down calmy and cut into one's flesh gives the most excruciating pain. When young we repeatedly cut great gashes on the fingers with a jack-knife, and felt but little pain at the time; but when it became necessary to lance the flesh to get a sliver out of the foot, or to cut open a stone-bruise, the pain was most intense.

To pare away with the razor until you get through the skin, and see the blood start—why, it makes the flesh creep to think of it now; but the clips that came unawares with the dull jack-knife were scarcely

heeded at all, more than to tie up the wound to keep the blood from soiling the work. Well, the point is, we are to take stings just as we used to take the cuts with those jack-knives, in our boyhood days. Of course, we are not to rush needlessly into

Effect of a sting near the eye of a novice.

danger; but when it comes, take it philosophically. Pull the sting out as quickly as possible, and do it in such a way as to avoid, as much as possible, squeezing the contents of the poison-bag into the wound. If you pick the sting out with the thumb and finger in the way that comes natural, you will probably get a fresh dose of poison in the act, and this will sometimes prove the most painful of the whole operation, causing the sting to swell when it otherwise would not have done so.

Too much emphasis can not be placed on the fact that the sting should be removed at once, for the reason that not only the pain but the swelling will be very much reduced. Of course if the poison-bag is squeezed, thus forcing the poison into the wound, in the act of removing, the effect will be as bad as if the sting were left in. We once received a sting on the upper eyelid; and as we were wearing glasses it was impossible to scratch it out immediately. The eye was suffused with tears, and it was impossible to locate the sting. Not being able to find any one to pull it out, the sting remained in the wound. This was certainly the worst "knock-out blow" that we ever received from a bee. Had we not been wearing glasses, the sting could easily have been brushed away with very little inconvenience.

THE PROPER WAY TO REMOVE A STING.

The blade of a knife, if one is handy, may be slid under the poison-bag, and the sting lifted out without pressing a particle more of the poison into the wound. When a knife-blade is not handy, push the sting out with the thumb or finger nail in much the same way. It is quite desirable that the sting be taken out as quickly as possible, for if the barbs (to be described further along) once get hold of the flesh, muscular contractions will rapidly work the sting deeper and deeper. Sometimes the sting separates, leaving part (one of the splinters, so to speak) in the wound. It has been suggested that we should be very careful to remove every one of these tiny points; but after trying many times to see what the effect would be, we have concluded that they do but little harm, and

Mr. Chalon Fowls, of Oberlin, Ohio, numbers among his customers an amateur beekeeper who has the faculty of seeing the bright side of life under adverse circumstances. This picture, sent to Mr. Fowls on a postcard, shows that it pays to "grin and bear it."

that the main thing is, to remove the part containing the poison-bag before it has emptied itself completely into the wound. When very busy, or having something in

the other hand to make it inconvenient to remove the sting with a knife or finger-nail, we have been in the habit of rubbing the sting out against the clothing, in such a way as to push the poison-bag off sidewise; and although this plan often breaks

Be proud of your swollen eye!
It isn't the fact that you're licked that counts;
It's how did you fight—and why?
EDMUND VANCE COOKE.

off the sting so as to leave splinters in the wound, we have found little if any more trouble from them than usual.

REMEDIES FOR BEE-STINGS.

For years past we have taken the ground that medicines of all kinds are of so little avail, if of any use at all, that the best way is to pay no attention to any of them. This has awakened a great deal of arguing, and the remedies that have been sent, which the writers knew were good, because they had tried them, have been enough to fill this whole chapter. We have tried a great many of them, and, for a time, we imagined they "did good;" but after giving them a more extended trial, we have been forced to conclude that they were entirely futile. Nay, further; they not only did no good; but if the directions with the remedy were to rub it in the wound, they did positive harm; for the friction diffused the poison more rapidly into the circulation, and made a painful swelling of what would have been very trifling, if let alone. Please bear in mind that the poison is introduced into the flesh through a puncture so minute that the finest cambric needle could by no manner of means enter where the sting did, and that the flesh closes over so completely after it as to be practically impossible for the remedy to penetrate this opening; now, even if you have a remedy that will neutralize the poison in something the same way that an alkali neutralizes any other acid, how are you to get it directly in contact with the poison? We know of no way of doing it unless we resort to a surgical operation; and if you will try that kind of "tinkering" with one bee-sting you will probably never want to try another. There is no remedy in the world like letting an ordinary sting alone, and going on with the work without even thinking about it. But, suppose we get a sting under the eye—one that closes up that very important organ; shall we go on with our work? That depends. If it brings on headache or causes great discomfort we would rest a while, and in the meantime apply a cold wet cloth until the local fever is allayed. Sometimes applying a hot and cold wet cloth alternately brings relief.

" Go vay, you bee!"

A year or two ago kerosene oil was suggested as a remedy, and two of our friends regarded it of such importance that they almost got into a controversy about who was entitled to the honor of the discovery. Well, having received a very bad sting on the hand, we went for the oil-can and

dropped oil on the spot for some time. As kerosene will remove a rusty bolt or screw when nothing else will avail, and as it seems to have a wonderful power of penetrating all cracks and crevices, we began to have faith that it might follow the sting of the bee, and in some way neutralize the poison. But the only result was one of the most painful and lasting stings we ever had.

"Ou-oo-ow-oo-o-u-c-h!!"

WHAT TO DO WHEN HORSES ARE STUNG A GREAT NUMBER OF TIMES AT ONCE.

Severe cases of stinging are usually the result of carelessness, either from allowing combs to be scattered, causing robbing, or because a hive has been bumped over by careless driving, or by some animal allowed the range of the apiary. There are a number of cases on record where horses have been stung to death; and it is hardly safe to hitch such animals within a few feet of a hive, nor yet to let them run loose in a beeyard, although a few sheep may be let in to keep the grass down to advantage.

Mr. Chalon Fowls, of Oberlin, Ohio, left a horse hitched near some hives of what he thought were gentle Italians; but by some means or other the animal bumped one of the hives, irritating the bees, causing them to rush out and sting. The horse, of course, began to plunge and kick, with the result that he demolished completely all the hives within reach. Mr. Fowls said the horse, when he could get to him, was almost literally covered with stings. He unhitched and led him away, and immediately called for a boiler of hot water. This was brought out as soon as it could be heated. Cloths and blankets were immersed in it, almost boiling hot, wrung nearly dry, and laid over the animal, now writhing in the severest agony. The moment Mr. Fowls applied the hot blankets he says the horse quieted down. During the escapade he himself was terribly stung in the face and on the hands; and he says that, as soon as the hot cloths were applied to his face he felt almost instant relief. The hot cloths were applied to the horse on every portion that was stung, and Mr. Fowls had the satisfaction of knowing that he could save his horse, which was soon as well as ever.

During the summer of 1902 at one of our outyards we had an experience which we thought at the time would be fatal to both man and beast. It came about somewhat in this way. A neighbor of ours who had a field of timothy near our yard had allowed his horse to eat grass within a few feet of the yard while he went to the further end of the field to look after some work. In the mean time the horse had managed to get over among the bees. The result was, she knocked over five hives, and was literally covered with stings when our neighbor came up. Being a practical beeman as well as a horseman himself, he rushed into the fray, freed the horse, and started her for the barn. The animal was beginning to swell badly, and it was evident to him that she would die before re-

lief could be given by a veterinary, even if called. He accordingly rolled up about a pound of common table salt in a paper, opened the animal's mouth, and with the left hand grasped her tongue, pulling it out as far as he could. He then with his right hand shoved the salt clear down her throat, reaching to his elbow. This done, he quickly closed her mouth and elevated her head until he saw the wad of salt go down the gullet. In a short time the horse showed relief, for the salt probably neutralized, to some extent, the effect of the acid poison. It also acted as a physic; for when a horse is sick at the stomach he can not vomit, and it is necessary to give him something at once to keep the bowels open. In three or four hours the horse was as well as ever.

Our neighbor did not apply wet blankets wrung out of hot water; but the veterinary, whom we consulted afterward, said that the giving of the salt was one of the best things that could have been done, and added that he would have wrapped the animal up in a blanket wrung out of hot water. If to this water was added a small quantity of ammonia, all the better. We suggest, then, if a horse is badly stung, it be given a dose of common salt, and treated to applications of hot blankets, and that the blankets be renewed often. Where hot water can not be obtained, use cold.

The moral of this is to keep bee-yards fenced off so that no stock or horses can get in. It is also advisable to locate the apiary a few rods from any line fence. See Apiary.

GETTING HARDENED TO STINGS.

When we first commenced beekeeping, stings swelled so badly, and were so painful, that we had either hands or eyes swelled up most of the time, until we seriously contemplated giving up the business, just on this account alone. After we had had a little more practice, we discovered that there was very little need of being stung at all, if one was careful not to provoke the ire of the little insects. Still further, we found the swelling to be gradually less and less; and before the first summer was over we very seldom felt the effects of any sting, the day afterward. When first commencing, if the eye was swelled so as to be closed by a sting, it often took until the third day to have it go down entirely. The A B C class, almost without exception, corroborate this experience.

HOW ONE WHO IS SERIOUSLY AFFECTED BY A SINGLE STING MAY BECOME COMPARATIVELY IMMUNE TO THE POISON.

There are some who are so seriously affected by the bee-sting poison that even a single sting will cause the body to break out in red blotches. Only one person in ten thousand is thus affected. So rare are the reported cases that the editors of *Gleanings in Bee Culture,* a journal with a circulation of over 30,000, do not hear of them once in ten years. But there are quite a number of others who are less affected but who inform us that a single sting produces great discomfort. While there is no danger of loss of life, the results of a sting are such that they have been obliged to give up the delightful pastime of keeping bees, very much to their regret. We have formerly advised all such persons when going among bees to be veiled and to wear gloves. But in late years we have found a better remedy. It was suggested by the fact that the average person becomes less and less affected by the bee-sting poison; and it occurred to us that, inasmuch as the human system has the power to withstand increasing doses of many poisons, after the first one, why should it not be able to immunize itself to a certain extent against the virus of bee-sting? It is a well-known fact, opium and morphine fiends are able to take doses of those drugs in amounts that would kill ten people who are not in the habit of taking them. The same thing is true of alcohol. Returning to the subject under consideration, we reasoned that, if one who is very seriously affected by bee-sting poison would just merely prick himself with a sting and then brush it off before it has had time to throw much of its virus into the wound, the after-effects would not be very serious; and that if the dose were repeated some four or five days afterward, or about the time the effect of the previous sting had passed away, one could, by continuing this process, ultimately apply the dose at more frequent intervals until in time his system would be no more affected than that of an ordinary person.

An interesting case came under observation, and we will relate the circumstances which may help others. A boy in our neighborhood, when stung, became so affected that his body would break out in great red blotches; his breathing grow difficult, and his heart begin to pound like a sledge hammer. It was really a question whether there was not danger of losing his life. Nevertheless he was very desirous of engaging in beekeeping, and determined to work with them. We finally suggested taking a live bee and pressing it on the back of his hand until it merely pierced his skin with the sting, then immediately brush off both bee and sting. This was done; and since no serious effect followed it was repeated inside of four or five days. This was continued for some three or four weeks, when the patient began to have a sort of itching sensation all over his body. The hypodermic injections of bee-sting poison were then discontinued. At the end of a month they were repeated at intervals of four or five days. Again after two or three weeks the itching sensation came on, but it was less pronounced. The patient was given a rest of about a month, when the doses were repeated as before. He then went to school and was not back for eight or nine months. On his return the applications were given again, when it was plainly noticeable that the after effects were becoming markedly less. He then went out into the bee-yard and was stung occasionally, but, beyond a small swelling locally, there was no unpleasant effect. However, as a matter of precaution when he went among the bees he always wore a veil and heavy gloves; for the stings, after passing through these goods, would have only a slight effect.

Some months afterward he was assisting one of our men at one of our yards, when, without warning, a colony of bees that was being dissected made a most furious attack on both the men. The young man who had been taking the immunizing doses of bee-virus received, he estimates, ten or a dozen stings all over his body. He had no veil nor gloves, for the other man was doing the work with the bees. He expected serious consequences; but, greatly to his surprise and gratification, no unpleasant effects followed. What was more, there was no swelling. Now, remember that this person used to be so seriously affected that a single sting would cause his parents to worry, as they feared he would not be able to survive the attack. He now handles bees with the same freedom that any experienced beekeeper does.

WHAT TO DO WHEN A PATIENT SUFFERS SEVERELY FROM ONE OR MORE STINGS.

In the foregoing, allusion was made to the fact that a person not used to stings may suffer severely from one or more stings. It is rare indeed that one sting causes any more than a local pain. Red blotches may break out all over the body. In other cases there may be shortness of breath, a faintness, some nausea, and a weak heart action. When the heart is affected it is very important to get the services of a physician at once to administer some heart stimulant. If the patient has been stung a great many times, cloths should be wrung out of hot water and applied to the body. Feet and hands should be kept warm, and the patient, if he has a weak pulse and difficulty in breathing, should be placed near an open window, or, better still, out on the porch where the cool breezes can strike him. If there is no air stirring, it would be well for some one to keep up a vigorous fanning of the face. The body should be warmly covered and protected until the doctor arrives. Where electricity is available an electric fan may be made to play across the face of the patient.

Where one suffers a shock and shows a weak pulse (and these cases are rare) he should be very careful after he recovers from attempting to do any hard manual labor for two or three weeks as he will probably suffer from the shock. He should avoid becoming overheated, and for a day or two after being stung he should be very quiet, keeping as cool as possible. Any exertion may bring back the old trouble of weak pulse, and this of course introduces an element of danger, if not the danger of leaving a permanent legacy of a bad heart.

Where there is no weak action of the heart, that is, the pulse seems to be good, but one suffers from a general fever over the body with red blotches all over, cold applications of cloths wrung out of water sometimes is sufficient to bring relief. Sometimes hot applications are better still, and

very often it happens that hot and cold in alternation proves beneficial. In all cases of severe stinging the patient should lie down and keep very quiet, and under no consideration should he attempt to do any hard work until he is sure he is clear past the shock.

HOW TO AVOID BEING STUNG.

Some may imagine that it is necessary for one who keeps bees to endure the pain of being stung several times every day. A lady once said that she could never stand it to have her husband keep 100 colonies, for she got stung four or five times a day from only a dozen, while 30 or 40 stings a day would be more than she could possibly bear. We could take any one of you into an apiary of 100 colonies, and have you assist us all day long, without your getting a single sting. Nay, further; if you are very timid, and can not bear a single sting, by taking some pains you may be able to work day after day, without being stung at all. The apiary must be properly cared for, no robbing allowed, and you must do exactly as we tell you. See Anger of Bees. In the first place, avoid standing right in front of any hive. We are often very much tried by visitors (some of them beekeepers, too, who ought to know better), because they will stand right before the entrance until they have a small swarm scolding them because they can not get out and in the hive, and then wonder why so many bees are buzzing about in that particular spot. If you should go into a factory, and stand in the way of the workmen until a dozen of them were blocked up with their arms full of boards and finished work, you would be pretty apt to be told to get out of the way. Now, you are to exercise the same common sense in an apiary. By watching flying bees you can tell at once their path through the air, and then keep out of their way. Right back of any hive is a pretty safe place to stand.

One of the first things to learn is to know whether a bee is angry or not, by the sounds it makes. You should all know by the hum of a bee, when it is gathering honey from the heads of clover in the fields, that it has no malice toward any living thing; it is the happy hum of honest industry and contentment. People sometimes jump when a bee sings harmlessly, whereas they should know better; but it is because bees are not in their line of business, and they don't know "bee-talk."

Well, when you go in front of a hive, or approach colonies that are not accustomed to being worked with, one of the sentinels will frequently take wing, and, by an angry and loud buzz, bid you begone. This note is quite unlike that of a bee upon the flowers, or of the ordinary laborer upon the wing; it is in a high key, and the tone, to us, sounds much like that of a scolding woman, and one who will be pretty sure to make her threats good if you do not heed the warning. When one of these bees approaches, you are first to lower your head, or, better still, tip down your hat-brim; for these fellows almost always instinctively aim for the eyes. It will often be satisfied, and go back into its hive if you move away a little; but one should be sure not to give it to understand that you admit yourself a thief, and that it has frightened you. If it grows very threatening, and you are timid, you had better enter some building. We are in the habit of opening the door of the honey-house, and asking visitors to go in there, when an angry bee persists in following them. Very many times we can hardly get them to go in as we direct, because they can not see why the bee will not follow them, and thus corner them up a sure prey. We do not know why it is, but a bee very seldom ventures to follow one indoors. A single bee seldom does, but a very vicious colony of hybrids, when fully aroused, may do so.

WHAT TO DO WHEN A SINGLE BEE FOLLOWS YOU ABOUT BY THE HOUR.

It not infrequently happens, especially in an apiary where there are many hybrids, that a single bee (of this "cross") will follow you about the apiary for hours, poising itself just before your eyes, making believe to sting. It does not pay to be humane toward such bees. While this offender is holding itself aloft before your face in a menacing manner, smash it between your hands, or, with a stick, give it a smart rap; but take care that you don't miss it, or it will stop its dallying and deliver its sting. In the use of the stick it is quite useless to strike at individual bees on the wing. It

is our plan to take up two sticks, or any thing that is handy, say an inch or so wide and a foot or two long. With a couple of these, one in each hand, we make rapid back-and-forth motions like an inverted pendulum in front of the face, working the sticks for a full minute or more. This excites the ire of cross bees, causing them to rush right out at the rapidly moving objects, with the result that they get their heads rapped right and left. We have had at various times perhaps a hundred bees buzzing about the head, and killed them all, by the method explained, in less time than it takes to tell it. Such bees, unless killed, will harrass one for perhaps an hour. If there be only a single bee you can kill it by slapping the palms of the hands together; but since you may receive a sting in so doing it is perhaps better to use a paddle made of a square of wire cloth tacked to a stick. A paddle of solid wood only fans the bee away, and misses it. The wire-cloth paddle hits.

HOW TO SAVE YOURSELF FROM A STING.

Sometimes a bee is noticed in the act of inserting its sting in your hand. When the other hand is not holding a frame, nor otherwise engaged, bring it to the rescue by smashing the bee before it succeeds. But where, as is sometimes the case, the other hand is holding a frame, slap against your person the hand which is being attacked. Should you do it aright you both smash the bee and also rub out the sting its owner has succeeded in plunging into the flesh. Never slap the hand directly against yourself, but give it a sort of wiping motion. You will thus accomplish the double purpose. If a bee strikes you in the back of the neck (when you have no veil), and lodges in your hair, smash it by that half-slap and half-rubbing motion. We recommend killing bees as above, when they have actually begun to insert their sting, because they are then, so far as we have been able to observe, determined to accomplish their purpose or die. Whenever possible we prefer to have them do the latter; for a bee if foiled after it has gone so far will most persistently carry out the principle of the little adage, "If at first you don't succeed," etc. See ANGER OF BEES.

Where no robbing has been going on, one usually gets warning enough, in ample time to take precautions. When colonies are quietly busy during the working season there is but little danger from bees in the air. While working with a hive, bending right over uncovered frames, you are comparatively secure from the bees of other stocks, for unless robbing, bees seem to have no disposition to meddle or hang around their neighbors' homes. This is one reason why bystanders at a little distance are so much more apt to be stung than the apiarist who is right among them.

JERKING THE HANDS BACK.

A good many times, especially where bees seem maliciously inclined, as you proceed to lift the frame three or four will strike against the hands, feinting to sting. The natural tendency, of course, is to jerk back the hand. This is the worst thing that you can do, ensuring a sting; whereas by holding your hands motionless to let the bees see that the new objects are not afraid they will rarely if ever go beyond a pretense of using their weapon. It is certain a large number of stings received by beginners on the hands are attributable to this jerking-back of the hands. The same is true in reference to the face, when unprotected by a veil. Nine-tenths of the bees which make such demonstration will not sting if you control your nerves, letting your tormentors know that you can not be frightened.

TO OPEN A HIVE WITHOUT BEING STUNG.

Have your smoker lighted and in good trim, then set it down near the hive you intend to examine. Now, we never use smoke on bees unless needful to subdue them; for why should we annoy the little fellows quietly going about their household duties unless obliged to? We frequently open hive after hive with no kind of use for smoke at all, and yet we often see beekeepers drive the poor little chaps down to the bottom of the hive with great volumes of smoke, when they have not shown the least symptoms of any disposition but the most friendly. It is true, where the colony is very large, the bees sometimes pile up in the way, on the rabbets and ends of the frames, so that it becomes desirable to drive them off for their own safety. This requires very little smoke; and if you are in no great hurry they will clear out of

the way if you just pat them on the backs gently with a weed or bit of grass. When bees are disposed to be cross, and show fight, you will readily discover it the minute you pry up the cover; and if it takes smoke to make them beg pardon, give it to them only in small quantities until you are sure more is needed. See FRAMES, HOW TO MANIPULATE.

WHAT KIND OF BEES STING WORST.

The general decision now is, that pure Italians, Caucasians, and Carniolans are the most easily handled. See BEES. Not only do they sting less, but as they keep their places on the combs without getting excited* when the hives are opened properly, they are far less likely to get under one's clothing than common bees. A great many stings are received from bees that are in no way badly disposed at all, simply from getting pinched accidentally while on the person of the beekeeper. The pure races may be handled all day, with no such mishap; but after working among the old-fashioned blacks or hybrids we often find a dozen or more under the coat, in the sleeves, if they can get up, and, worst of all, up the trousers, unless the precaution has been taken to tuck them into the boots or stockings when wearing low shoes. See VEILS. This one thing alone would decide one in favor of the Italians, if they were simply equal to the blacks in other respects. Hybrids, as before stated, are worse to sting than either of the races when pure; while Cyprian and Holy-Land bees are so much worse still, that sometimes smoke has no effect on them. See CYPRIANS, under ITALIANS; also BEES.

It may be well to add, that we find many exceptions to these rules; a colony of blacks will sometimes be much easier to handle than one of Italians in the same yard; and the progeny of a queen that we may have every other reason to call pure may be as cross as the worst hybrids. Still further: A very cross colony of bees may be so educated, by careful treatment, as to become very gentle, and *vice versa.* The colony in front of the door of the honey-house was always a gentle one, season after season; the explanation being that they became accustomed to the continual passing and repassing of the beekeeper in front of their hive, and learned to be dodging past some one almost all the time. On the contrary, those located in the remote corners of the apiary are very apt to sting, if you just come round to take a view of their entrance. Egyptian bees are said to be much worse than any of the other races; and as they do not yield to smoke, as do others, they have been discarded principally on account of this unpleasant feature.

* Queenless bees are not as quiet It may be because they seldom work with energy, and have therefore no fresh accumulation of stores, which tend so much to put bees on their good behavior. All bees are much worse after a sudden stoppage of nectar secretion, especially after a basswood or buckwheat flow.

BEE-STING POISON.

When bees are very angry and elevate that portion of their bodies containing the sting, you will often see a tiny drop of some transparent liquid on its point. This liquid is the poison of the bee's sting. It has a sharp, pungent taste; and when thrown in the eyes, as sometimes happens, it has a stinging, acrid feeling, as if it might be a compound of cayenne pepper, onion-juice, and horseradish combined; and one who tastes it or gets its in his eyes concludes it is not so strange that such a substance, introduced into the circulation, should produce severe pain. The poison of the bee's sting has been thought to be similar in composition to that of the viper and scorpion; others have claimed that it is formic acid.*

HOW IT IS DONE.

It is quite an interesting experiment to let a bee sting you on the hand, and then coolly observe the whole performance without disturbing it. We have sometimes, in trying to see how far we could go with an angry colony of bees without the use of smoke, had a lot of them strike the face with a sudden dash; but as we kept perfectly still they would alight without stinging. Now, the slightest movement, even an incautious breath, might result in some pretty severe stinging; but by keeping cool and quiet, carefully walking away, escape becomes possible without any stings at all. Very often a single bee works itself up in a sufficient passion to try to sting; but to commence while standing still, we have always found to be rather difficult work for them; although they sometimes prick

* For a long time it was said to be formic acid, but the latest investigations show that the poison is entirely apart from formic acid.—C. C. M.

slightly, giving one a touch of poison, they seldom sting very severely without taking wing again. To go back: After the bee has penetrated the flesh of your hand, and worked the sting so deeply as to be satisfied, it begins to find itself a prisoner, and to consider means of escape. It usually gets smashed at about this stage of proceedings unless successful in tearing the sting—poison-bag and all—from the body; however, if allowed to work quietly it seldom does this, knowing that such a proceeding seriously maims for life, often even killing the bee. After pulling at the sting to see that it will not come out, it seems to consider the matter a little, and then commences to walk around the sting, in a circle, just as if trying to twist a screw out of a board. If you can be patient and let the bee alone, it may work it out, but in most cases the sting either tears out from the body of the bee or breaks off. We need not tell you that it takes some heroism to submit patiently to all this maneuvering. The temptation is almost ungovernable, while experiencing the intense pain, to say, while you give it a clip, "There, you little beggar, take that, if you can not learn better manners in future."

ODOR OF BEE-STING POISON.

After you have been stung on the hand, its use among the bees in the hive will be pretty sure to get you more stings, perhaps due to the odor of virus, unless you are very careful. After one sting has been inflicted, there seems a much greater chance, when about in the apiary, of getting more stings. Mr. Quinby has suggested that this is owing to the smell of the poison, and that the use of smoke will neutralize this scent. We very often blow smoke on the wound. The heat relieves the pain somewhat, and the smoke obscures the bee-sting odor. There is no doubt about that.

POISON OF THE BEE-STING AS A REMEDIAL AGENT.

For some years past there have been running in our bee-journals many reports in regard to the agency of bee-stings in the cure of certain forms of diseases, especially rheumatism. From the facts put forth, any candid reasoner will have to admit that being stung frequently does have the effect of relieving certain forms of rheumatism, paralysis, and perhaps dropsy.

Numerous accounts have also appeared in the daily papers of various persons affected with rheumatism being greatly relieved by stings, especially on the affected parts. Some others have reported that they could discover no appreciable effect one way or the other.

It has happened at various field-day gatherings of beekeepers that certain parties who read these reports, having suffered severely because of rheumatic pains, presented themselves and asked to have experts cause the bees to sting them on the affected parts. The operator picks a bee off a comb by the wings and presses it against the flesh until the sting is driven into the skin. This has been done on several occasions, and in each case the parties who came forward for this kind of treatment have said they experienced relief. At the Jenkintown field-day meeting, June 26, 1906, an old gentleman got up on the platform, and, before something like a thousand people, stings were applied to his arm until something like a hundred were imbedded deeply in the flesh. Did it hurt? Oh, yes! But the induced fever of the stings, he said, seemed to bring a warmth and toning of the muscles that was after all a relief; for, strangely enough, this large number of stings does not seem to affect a rheumatic leg or arm as it does a healthy member.

It is a well-known fact that the homeopathic school has for many years used bee-sting poison in a remedy called "apis mellifica." There are large wholesale drug-houses that have made a business of buying stings taken from live bees, being dropped, as they are extracted, into small vials containing sugar of milk. We have filled orders from our apiaries for bee-stings to the extent of 10,000 in one lot. From a frame of live bees placed in a convenient position a bee is picked up with a pair of broad-nosed tweezers and immediately crushed. This act forces out the sting, when it is immediately grasped by another pair of fine-pointed tweezers. These are then given a sharp rap over a wide-mouthed bottle containing sugar of milk. In this way the stings are extracted one by one until the whole number has been pulled. But the operator, after having extracted

four or five thousand, experiences a sort of tingling and itching sensation in the face, and finds he has to take a rest of some days before he can renew his work. At other times it happens that he can extract only a few hundred a day when that itching sensation will reappear. This is probably due to the fact that he inhales some of the fumes of the poison, which, entering the lungs, is absorbed by the blood and carried through the system.

At other times a pound or so of bees is put into a large wide-mouthed bottle or jar of alcohol. But the poison of the stings extracted in this way must necessarily be mixed with the other juices of the bees.

Homeopathic physicians have "apis mellifica," thus made from bee-stings, supplied to them in the form of a liquid. It smells not unlike bee-sting poison, and is often given internally to relieve the pain of rheumatism or swellings in general. But it is evident that a hypodermic injection of the bees, given directly on the affected part, would be a hundred times more productive of good results, assuming, of course, the poison does have a remedial effect.

DOES A BEE DIE AFTER LOSING ITS STING?

It has been stated that the loss of the sting results in the death of the bee within a very few hours; but this can hardly be true. Colonies have at times become so enraged as to sting every thing within reach, even plunging their little javelins into fence-posts and other inanimate objects, the result being that nearly every bee of the hives in the fracas would lose its sting, and yet these same colonies live and prosper. One correspondent in particular relates the following incident:

Through carelessness he allowed a certain one of his colonies to become so infuriated as to sting everybody and every thing within reach. He declared, upon a subsequent examination, that there was scarcely a bee in that whole colony which did not show unmistakable evidence of having lost its sting in the uproar just mentioned. Now, the singular fact was that these bees actually lived, gathered honey, and prospered.

That *some* bees die after losing their sting, may be true; but that they invariably do so is a claim now thoroughly discredited.

SMOKE NOT ALWAYS A PREVENTIVE OF BEE-STINGS.

There are some colonies that, under some conditions, can not be conquered, even with smoke. If the atmosphere is a little chilly, or immediately after a rain, or if the supply of nectar has suddenly stopped short off, a few colonies may be very hard to handle. While most bees under these conditions will yield to smoke, it seems to infuriate others. The only thing to do is to let them alone for the time being; then the next day or two, when the weather is favorable, blow a little smoke in at the entrance, raise the cover very gently, blow in a few whiffs more, when, presto! the fiends of the day before are as gentle as kittens.

MECHANICAL CONSTRUCTION AND OPERATION OF THE STING.

After a bee has stung you, and torn itself away from the sting, you will notice, if you look closely, a bundle of muscles near by and partly enveloping the poison-bag. Well, the curious part of it is that for some considerable time after the sting has been detached from the body of the bee, these muscles will work with a kind of pump-like motion forcing the sting further into the wound, as if they had a conscious existence and burned with desire to wreak vengeance on the party attacked. Nay, further, after the sting has been pulled from the flesh, and thrown away, if it should stick in your clothing so your flesh will come in contact with it, it will commence working again, pull itself into the flesh, and empty the poison into the wound, precisely as if the living bee were itself working it. We have suffered many times from a sting unconnected with any bee. Without precise figures, we should say a sting would hold life enough to give a very painful wound, for fully five minutes, and it may be in some cases even ten minutes.* This phenomenon is wonderful, and we have often, while watching the sting sink into the rim of a felt hat, pondered on that wonderful thing, animal life. Why should that isolated sting behave in this manner, when the bee to which it belonged was perhaps far away, buzzing through the air? Why should this bundle of fibers and

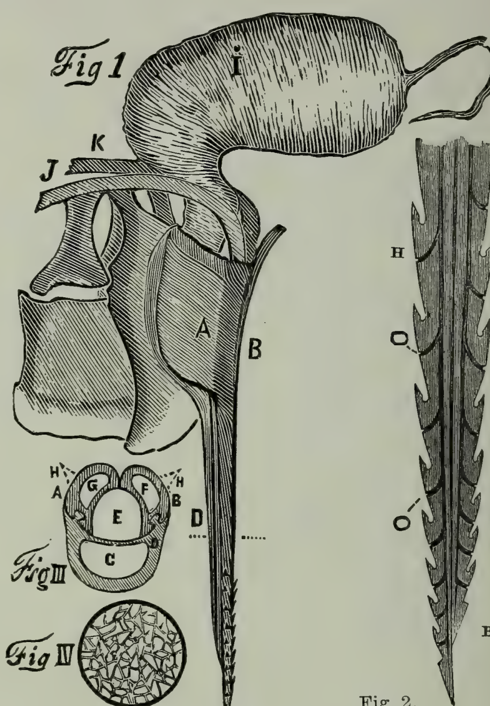
* Muscular contraction of the sting has taken place under the field of the miscroscope 20 minutes after being detached from the bee.

muscles behave as if it had a life to throw away?* We do not know. This, however, we do know; when you pull a sting from the wound, you should throw it far enough away so that it will not get back on your face or hands, or into your hair, to sting you again.

In giving the following description of a bee-sting, we are indebted to the drawings and description given by J. R. Bledsoe, of Natchez, Mississippi, in the *American Bee Journal* for August, 1870. We are also indebted to Prof. Cook's excellent Manual.

Under the microscope the sting is found to be a beautifully fashioned and polished instrument, whose delicate taper and finish make a most surprising contrast with any instrument man has been able to produce. In shape it appears to be round; but it is, in reality, egg-shaped, and is of a dark-red color, but transparent enough to show the hollow running through the center of each of its parts. These probably secure lightness as well as strength.

We give you three views, like letters representing like parts in all. Bear in mind that the sting proper is composed of three parts—the outer shell, or husk, D, and two barbed spears that slide partly inside of it. In Fig. 2 we show you the spears. The barbs are much like those on a common fish-hook; and when the point of one spear, A, penetrates far enough to get one barb under the skin, the bee has made a hold, and has no difficulty in sinking the sting its whole length into the wound; for the pumping motion at once commences, and the other spear, B, slides down a little beyond A, then A beyond B, and so on. The manner in which these spears are worked is, as nearly as we can make out, with a pair of something like pump-handles, operated by small but powerful muscles. We have shown you the arrangement of these handles at J and K, Fig. 1, as nearly as we could conjecture what it must be, from watching its workings under the microscope. These muscles will work, at intervals, for some time after the sting has been torn from the bee, as we have explained. They work with sufficient power to send the sting through a felt hat or into a tough buckskin glove. We have often watched the bee while attempting to get its sting started into the hard cuticle on the inside of the hand. The spears often run along the surface diagonally, so that you can see how they work down by successive



Bee-sting magnified.

pumps. The hollow in these spears is indicated at G and F, in Figs. 2 and 3; O, O, ducts leading from G and F.

We are not certain as to the real office of these ducts, O, O, but have sometimes thought that they were for the purpose of conducting the poison to the wound from the canals G and F, the latter communicating directly with the poison-bag itself. Indeed, Frank Cheshire says they afford the only means of exit for the poison, but Entomologist Snodgrass, of the Bureau of Entomology, says this is a mistake. Under the microscope these ducts show very plainly, and these openings occurring just as they do between the points of the barbs, seem to favor the opinion of Cheshire.

Fig. 3 is a transverse section, sliced across the three parts, at about the dotted line D. A and B are the barbed spears; F and G, the hollows to give them lightness and strength; H, H, the barbs. It will be observed that the husk, D, incloses but little more than one-third of the spears.

* A nerve center is attached. In insects each such center is to an extent an independent brain.—A. C. M.

Now, the purpose of this husk is to hold the spears in place, and to allow them to slide easily up and down, also to direct them while doing this work. To hold all together, there is a groove like a sliding dovetailed joint in both spears, with a corresponding projection in the husk, which fit each other as shown. This allows the barbs to project to do their work, and yet holds all together tolerably firm. We say tolerably firm, for these spears are very easily torn out of the husk; and after a sting is extracted they are often left in the wound, like the tiny splinters we have before mentioned. When torn out and laid on a slip of glass they are scarcely visible to the naked eye; but under the microscope they appear as in Fig. 2.

Stings do not all have the same number of barbs. We have seen as few as seven and as many as nine. The two spears are held against each other as shown in Fig. 3, and you will observe that the shape and the arrangement of the three parts leaves the hollow, E, in their center. The working of the spears also pumps down poison, and quite a good-sized drop collected on their points while we saw them working under the microscope. Friend Bledsoe found a valve that lets it out of the poison-bag into this wonderful little pump, but prevents it returning. We have not been able to see this, but have no doubt that it is there. The drop of poison, after lying on the glass a few minutes, dries down and seems to leave a gummy substance that crystallizes, as it were, into strange and beautiful forms. We have tried to show it to you in Fig. 4.

SUCROSE.—See Cane Sugar.

SUGAR.—The term sugar is applied, by common consent, to the pure sugar commerciallly prepared from the sugar-cane and the sugar beet, or sucrose. There are, however, many more sugars of varying character. Common sugar is composed of the elements—carbon, 12 parts; hydrogen, 22 parts; oxygen, 11 parts. A white sugar or granulated sugar is a pure sucrose, while the varying-off colors, ranging from light yellow to brown, are mostly mixtures of sucrose and varying quantities of molasses. These are prepared first in the process of manufacture, and are known as coffee, yellow prime, yellow clarified, and brown sugar. By washing with water, and refining, they are made into white sugar.

The yellow sugars have somewhat of a molasses taste which is particularly agreeable to some people. See Cane Sugar.

SUMAC. — There are eight recognized varieties and some hybrids. Only three varieties are notable as honey-plants. The best one is *R. glabra,* or smooth sumac, conspicuous for its conical clusters of rich velvety crimson fruit. It grows in height from 2 to 10 feet, thrives in poor or nearly barren soil, and in June and July sends up large clusters of pale yellowish-green flowers (see illustration). It yields abundantly, and the honey is very light in color, of heavy body and excellent flavor.

Sumac, smooth (*Rhus glabra*).

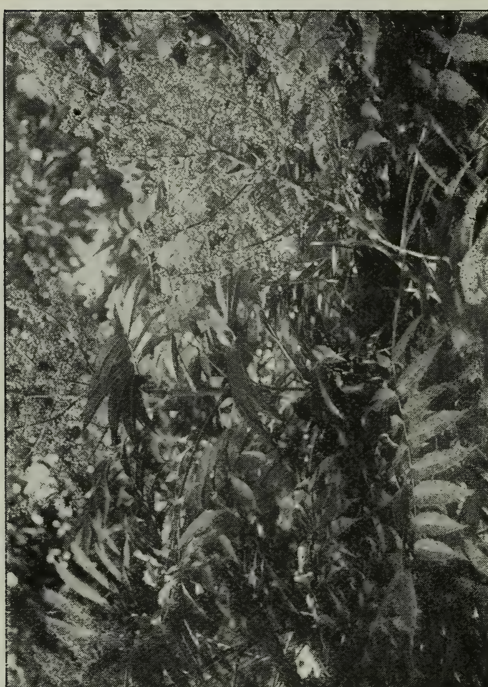
R. coppalina.—Dwarf sumac grows from 1 to 7 feet high, prefers rocky hills, and is not so good a yielder as the *R. glabra,* but does wonderfully well in some locations. It flowers later than the other.

R. toxicodendron, poison ivy, poison oak, is a climbing vine, very vigorous grower, often yielding a satisfactory surplus.

R. typhina, staghorn sumac, is a beautiful tree growing from 10 to 30 feet high. The young shoots are covered with velvety hairs like a stag's horns, hence the name. It is not particularly important as a honey-plant, though in flower and fruit it resembles *R. glabra,* with which it hybridizes.

Rhus metopium and *Metopium metopium* (Small); known as coral sumac, poison

wood; doctor gum.—A tree of the sumac family, growing commonly on the extreme southern part of the Florida peninsula and the Keys. Its characteristics are, a flaky bark and poisonous sap; requires high ground to do well; grows to a height of 40 or 50 feet, and is found as far North as Palm Beach. Its common names are *very* misleading and numerous. See the list at heading of this article. It is often (but erroneously) termed "manchineel," from confusion with the tree of that name, which it closely resembles in many particulars, but is much more common than the real manchineel, which is much more poisonous. Both have the acrid sap which heightens the danger of confusion between them. Of this sap from the *Metopium*, Prof. Rolfs, head of the Agricultural Department of the Florida State University, says: "The juice is poisonous to a great many people. I have repeatedly received a daub of it myself, but it never proved severe." It resembles poison ivy in being harmful only to certain skins. "Poison wood" is the name commonly given to this scraggy old sumac tree by the "Conchs," or natives of the Keys. Unattractive as the name sounds for a honey-producer, it nevertheless yields honey of a high order, and in great quantities. In some seasons the bees are said to go fairly wild with excitement over it. While the honey is of good quality, its exact color, body, and flavor can never, probably, be determined with exactness, for it blossoms simultaneously with several other honey-bearing plants or trees (notably with the dogwood and also the pigeon-plum), so that only a blend of several honeys is possible. The blend of the three is thick and appetizing, of good color, and usually brings high prices in the northern markets. It constitutes most of the surplus of Mr. O. O. Poppleton, of Stewart, Fla. In 1909 his crop was 28,000 lbs.



Sumac flowers and leaves (*Rhus glabra*).

SUNFLOWER (*Helianthus annuus* L.)—An extensive American genus embracing about 60 species. There are about 22 species in northeastern America. The two most important honey plants are the common sunflower and the Jerusalem artichoke. The former grows wild throughout the western States, and is widely cultivated in the east. M. H. Mendleson, of Ventura, California, says that one year he extracted a carload of wild sunflower honey, but that never before nor since has it been so plentiful. It blooms in that State from July to September. According to Richter, the honey is amber-colored, with a characteristic flavor not disliked by many; but from Sacramento County it is reported to be black-colored. Scholl says that in Texas the bees gather much propolis, both from the flowers and leaves. In Florida the wild sunflower is very abundant east of the Miakka River, where it probably yields considerable honey. The seed is produced in large quantities, and is an inexpensive and nourishing food for poultry. Both species of sunflower mentioned above are great favorites of bees. Besides being a good honey plant the Jerusalem artichoke (*H. tuberosus* L.), according to Pryal, is a good tuber to plant for raising feed for hogs without much labor or expense. The tubers are also used as a vegetable, and are greatly relished by some people.

SWARMING.—All animated nature seems to have some means of reproducing its kind, that the species may not become extinct; and, especially among the insect

tribes, we find a great diversity of ways and means for accomplishing this object. In the microscopic world we find simple forms of animal life contracting themselves in the middle until they break in two, and then each separate part, after a time, breaks in two, and so on. With bees we have a somewhat similar phenomenon. Where a colony gets excessively strong, the inmates of the hive, by a sort of preconcerted mutual agreement, divide themselves off into two parties, one remaining in the old hive, and the other starting out to seek their fortunes elsewhere.

We have carefully watched this proceeding, with a view of determining how the matter comes about, that is, whether it is because a part of the bees become dissatisfied with their old home and seek to better their condition, or because the queen leaves, for some reason of her own (because she has not room to lay her eggs, for instance), and the bees simply follow from a sort of natural instinct, since she is the mother of the colony and an absolute necessity to their prosperity. After seeing a number of swarms issue, and finding that the queen was among the last to leave the hive, we concluded that the bees take the lead, and that the queen simply followed as a matter of course in the general melee. Suppose, however, that the queen should not take a notion to join the new adventure. Swarms do sometimes start out without a queen accompanying them, but they usually go back to the hive after a time, to try it again next day. If she does not go then, nor at the next attempt, they often wait until they can rear a new queen, and then go off with her. After we were pretty well satisfied that this is the correct idea of their plan, a little circumstance seemed to upset it all. A neighbor, wanting to make an observatory hive, drummed perhaps a quart of bees from one of his old hives. As he had no queen, we gave him a black one taken from a colony purchased several miles away. We mention this to show that the queen had never been out of the hive, in the location which it then occupied. After a day or two, this neighbor informed us that we had played a fine trick on him, for our queen had gone home, and taken his quart of bees with her. We told him it was impossible, for she had never been out of the hive, except when we carried her over in the cage.

We went and looked in the hive she came from, and there she was, true enough, with the bees she had brought with her stung to death in front and on the bottom-board. It is possible that the bees swarmed out first; but even if they did, they certainly followed the queen in going back to her old home. We also know that bees sometimes follow a young queen when she goes out to take her wedding-flight.

It is our opinion that neither queen nor workers alone make the first start, but all hands join together and act in concert.*

WHY BEES SWARM.

If we attempt to contract the size of the hive when honey is coming in bountifully, the bees will be very apt to take measures toward swarming about as soon as the combs are full of brood, eggs, pollen, and honey. They will often wait several days after the hive is seemingly full; and while this course may not cause them to swarm at all, it is very likely to. As soon as it has been decided that the hive is too small, and that there is no feasible place for storing extra supplies of honey where it can be procured in the winter, as needed, they generally commence queen-cells. Before doing this we have known them to go so far as to store their honey outside on the portico, or even underneath the hives, thus indicating most clearly their want of extra space for stores where they could protect them.

Want of room is probably the most general cause of swarming, although it is not the only one; for bees often swarm incessantly when they have a hive only partly filled with comb. First swarms usually come about from the cause we have mentioned; but AFTER-SWARMING (which see) often gets to be a sort of mania with the bees, and they swarm, apparently, *without* a reason.

AT WHAT SEASON BEES USUALLY SWARM.

The old adage runs,—

A swarm of bees in May
Is worth a load of hay;
A swarm of bees in June
Is worth a silver spoon;
A swarm of bees in July
Is not worth a fly.

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* It starts with one worker in one place, then with another elsewhere, and spreads rapidly. The individual acts as if it had gone crazy. See BEE BEHAVIOR.—A. C. M.

There is much truth in this for the North, on the old plan; but with the modern improvements a swarm in July and August may be worth a silver spoon, or even a load of hay; possibly both together. See AFTER-SWARMING. A colony that was very populous in the fall, and has wintered finely, may cast the first swarm in May, in this latitude; but such events were very unusual before the advent of Italians. The latter often swarm during fruit-bloom, and in some cases even earlier. In our own locality swarms do not usually issue until the middle or last of June. If the season is a little late, sometimes the greater part of them will come in July, and we almost always have more or less swarming going on during our national holiday. At this time basswood is generally at its height, and we frequently have quite a yield from clover after basswood is gone. On this account, swarms that come out during the first week in July usually get enough to winter, and are therefore worth the price of a swarm of bees any way. The old adage doubtless referred principally to the amount of honey they would store; if the July swarms did not secure enough to winter over, and were allowed to starve. they would not be worth the trouble of hiving them, and so they might be rated as of less value than a fly. Swarms that come out in June would fill their hives, and perhaps make a surplus that, on an average, would bring at least a dollar, the old price of a silver spoon: while those that were so thrifty as to be able to start in May would have the whole season before them; and if they did not get set back before white clover came out, would very likely made a surplus worth $5.00, the market price then of a load of hay. In some localities bees seem to swarm in the latter part of July and August, and reports seem to show that they do so when little or no honey is to be had, and when the bees are disposed to rob; but such is certainly not the case here, for our bees give up all preparations for swarming some little time before the honey flow has ceased. In some localities buckwheat swarms are a very common thing. Where the apiarist has plenty of extra combs filled with stores, it is an easy matter to care for and make valuable stocks of swarms that issue at any time.

SYMPTOMS OF SWARMING.

Although we can sometimes tell when bees are going to swarm, we do not think it will be safe, by any means, to assume we can always do so. It has been said that all the bees which have been clustering on the outside will, the morning of the day they are intending to swarm, go inside the hive; but this can not always be so, for we have seen a swarm issue while the loafers were hanging on the outside as usual; and at the sound of the swarming note they took wing and joined in. Where a colony is intending to swarm, they will not be working like the rest, as a general thing; and, quite likely, on the day they are intending to swarm, very few bees comparatively will be seen going out and in at the hive. With movable combs we can generally give a very good guess of the disposition to swarm by opening the hive. Bees do not, as a rule, swarm until they have their hive pretty well filled up, and have multitudes of young bees hatching out daily. The presence of queen-cells is generally considered an indication of the swarming fever.

Many think that the clustering of the bees on the outside of the hives is an indication that they are going to swarm. To a certain extent this may be the case, but it is by no means an indication that they are going to swarm very soon. We knew a colony, belonging to a neighbor, that hung out in great masses nearly a month before the bees came out. His new hive was in readiness, and he stayed at home and watched day after day, until clover and basswood were almost gone, when finally they cast a large fine swarm. For cause of clustering out, see ENTRANCES.

As to the question whether bees choose a location before swarming, see ABSCONDING SWARMS.

NEVER ALLOW BEES TO HANG OUTSIDE THE HIVE.

One of our swarms hung outside the hive during a great honey-harvest; and as it is no unusual thing for a colony to store 10 lbs. a day in the height of the season (see SCALE HIVE) they may have lost 100 lbs., for the swarm was an unusually fine and strong one. They might easily have secured this amount if they had worked, but it is by no means certain that they could

have been made to go to work as they did after they swarmed and were put into a new hive. Within two or three weeks after they swarmed, if we remember, they filled their hive and gave about 25 lbs. of surplus. How shall we deal with such?

This clustering-out may be caused by the fact that the bees need room. In that case, obviously, an extracting or a comb-honey super should be placed on top; for where bees get into the habit of loafing it becomes a little hard to get them to go up into the supers. In such case we advise giving the bees a section or two of foundation partly drawn out, as previously explained under COMB HONEY. We would at the same time also enlarge the entrance. Set the hive up on four blocks $\frac{7}{8}$ inch thick, as shown under ENTRANCES, and further on under this head, sub-head CONTROL OF SWARMING BY MEANS OF LARGE OR PLURAL ENTRANCES. This will leave an open space all around the hive, but that will do no harm. If the primary cause of the bees clustering out in the first place is lack of ventilation, or too great heat, this raising-up of the hive will cause the bees to go in, and possibly prevent swarming.

SWARMING MODIFIED BY LOCALITY.

The commencement of the swarming season varies, of course, according to the locality, and it may be said that the swarm-

How a swarm will sometimes occupy a small tree, and bend it over by its weight.

ing propensity itself is modified very materially also by the same cause. In places where the honey-flow is very heavy and continues so for some time, swarming seems to be checked, for the bees are all intent on gathering honey. Indeed, they have no time to waste on such foolishness. In such localities the swarming season comes on when the first or light honey-flow

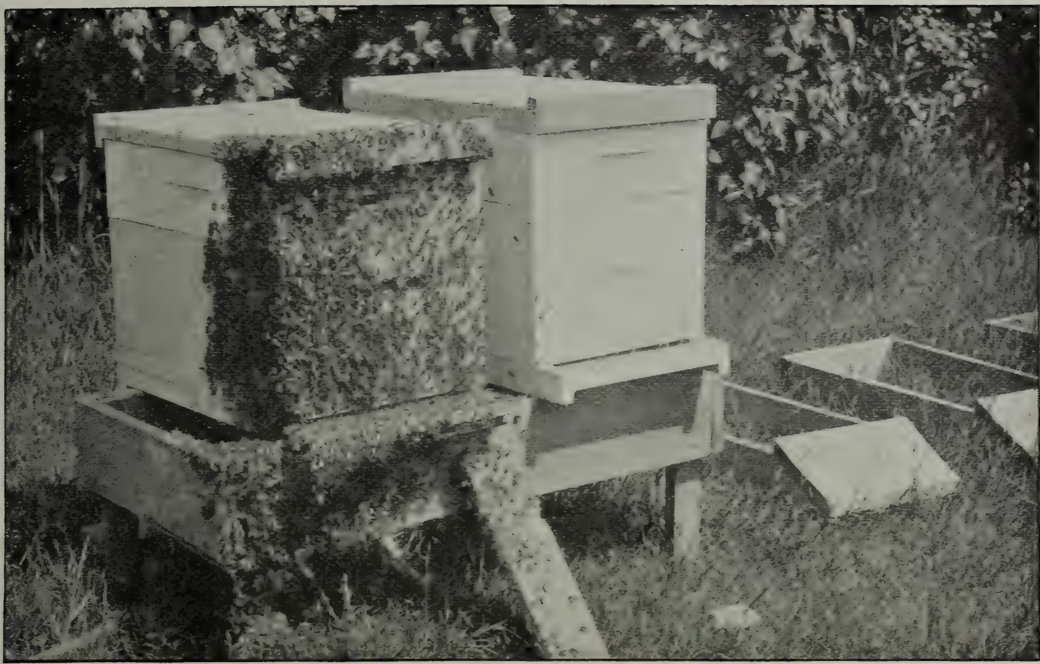
A live bee-hat.

begins, and continues so long as it is light; but just as soon as the secretion of nectar gets heavy, then just that soon swarming stops.

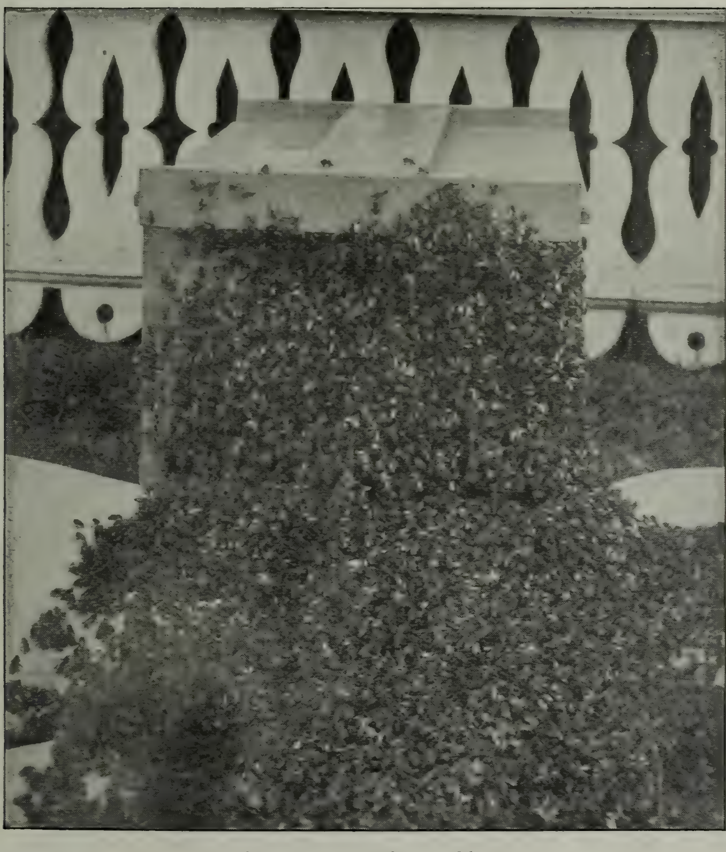
It sometimes happens that a beekeeper residing in one of these localities wonders why his brethren in the craft make so much fuss in the bee-journals about swarm control when he has no trouble from that source at all. The other fellow, on the other hand, can not understand how the first-mentioned beekeeper can perform certain manipulations with his bees, and not have excessive swarming. In reading the following pages treating on this general subject one must bear in mind this question of locality. It should, therefore, be said that much of the matter that follows relates to conditions as we generally find them in the Northern States, and not as they are found in parts of Texas, California, and some portions of the tropics. In these localities there may or may not be swarming. On the other hand, the beekeeper encourages it to a certain extent; and when he wishes it to cease by reason of the heavy honey-flow it stops naturally. This phenomenon is noticed sometimes in the North in a heavy and continuous honey-flow.

PREPARATIONS FOR SWARMING TO BE MADE BY THE BEEKEEPER.

Every apiarist, even if he has but a couple of hives, should make preparations for swarming, to some extent; for, even though dividing (see NUCLEUS, also INCREASE) is practiced, and utmost care used to prevent swarms, there will always be a chance that one may come out unexpectedly. First of all, before the swarming season the wings of all queens should be clipped, and hives made ready, extra combs placed in the honey-house where you can put your hand on them at any minute. We would also have some colonies marked where we could get a comb of unsealed larvæ without very much trouble; that is, make up your mind what hive you are to go to, in case you should want such a comb in a hurry. Bees will often swarm on Sunday; and as we do not wish to work with our bees on the Sabbath more than is absolutely necessary, it behooves us to be at all times prepared to take care of a swarm with very little trouble. We can remember having swarms on Sunday, when it became necessary to hunt up a hive, decide on its location, hunt up some empty combs, and then look over colonies to find one with no surplus boxes on, that we might get at a brood-comb with as little trouble as possible to put in the new hive, to prevent them decamping. All these things take time, and more than one swarm has departed while a hive was being made ready to receive them. If you keep the wings of your queens clipped as we have advised, you will need some queen-cages where you can lay your hands on them at



A colony caught in the act of swarming.



A swarm entering a hive.

a minute's notice,* for there are times when you need to step about as lively as you would at a house on fire, so you do not want to be bothered by hunting for things.

MILLER QUEEN-CATCHER.

The best queen-catcher, or, rather, cage for confining the queen during the swarming season, is the Miller introducing-cage, a cut of which will be found under INTRODUCING. We will suppose that a swarm has just issued, and that your clipped queen is hopping around the entrance of the hive. Your wife or attendant, feeling some hesitancy about picking up so delicate an object by her silken wings, can take a cage of this kind and place the mouth directly over her. In a moment, finding herself confined, she will ascend into the cage. The little wooden plug is now inserted, when your captive queen can be placed among the flying bees, and the swarm hived as next described. The cage is also used for introducing. See INTRODUCING.

HOW TO HIVE A SWARM WITH CLIPPED QUEEN; THE PLAN WE PREFER.

Under the general head of QUEENS, subhead CLIPPING, we have already given intimation how swarming can be controlled to a certain extent by clipping. Where the plan of forcing the swarm ahead of time by brushing or shaking† is not practiced, clipping has come to be almost universal among comb-honey producers; for where queens' wings are clipped, or they are prevented from leaving the hive by the use of Alley traps or entrance-guards (see DRONES), a great amount of labor will be saved.

We shall assume that all queens in the apiary have their wings clipped. A swarm comes forth. Go to the hive from which it is issuing; and, while they are coming out, find the queen, which will be found, in all probability, hopping around in the grass near the entrance, vainly endeavoring to fly with the rest of the bees. Cage her, and then slip the cage into a pocket or some cool place, temporarily. Remove the super or supers in which the bees have already started work, and set them on the ground near the hive. The brood-chamber should now be removed just as it is, to an entirely new location. Put in its place on the old stand a hive containing frames of foundation or empty combs, and on top of this a queen-excluding honey-board. Some prefer having only starters of foundation. Next put the supers, placed on the ground temporarily, on the new hive containing these frames of foundation or combs. Now lay the caged queen in front of the entrance.

All this may be done while the bees are in the air, and it will not be long before they discover that the queen is not with them, and return pellmell to their old location, and rush into the new hive. After they are well started going in, the queen may be released, when she will go with them.

The work already begun in the supers will be pushed on and completed with more vim and energy than before, because a new swarm always works with new energy. If only frames containing starters have been given them, what honey does come in is forced right into the supers, for the bees have absolutely no place to store it, at least until foundation below has been drawn out; but as soon as this takes place it is occupied immediately by the queen.

The old hive containing frames of brood and queen-cells now in another location may cast a second or third swarm; but if queen-cells are cut out, even second swarming may, to a very great extent, be checked.

This method of handling swarms where natural swarming is allowed commends itself especially to the women-folks, who are generally at home. All they have to do is to hunt up the clipped queen, cage her, and then put an empty hive containing frames of foundation in place of the old one. As it might not be practical for the women to carry the old hive to another location, they can simply drag it over to one side, and change the entrance so that it will face to the rear. When the "man of the house" returns, he can lift the supers off from the old stand on to the new one, then take the old brood-nest over to another location. This may be done any time within a day; or, when preferred, the old hive can be left alongside the new one, providing the entrance is reversed.

If two or more swarms come out at the same time, and one of them has a virgin queen, all the bees will be likely to unite

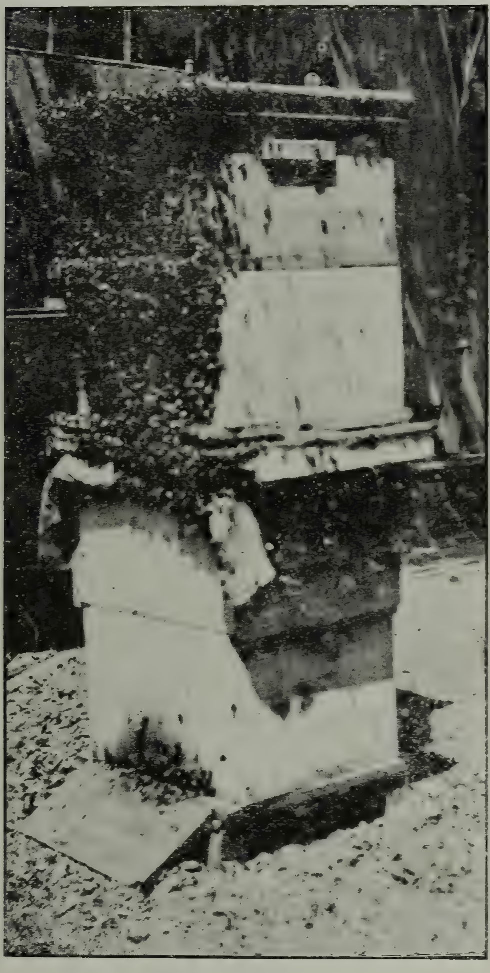
* Use pasteboard pill-boxes with half a dozen pinholes in the top and bottom.—A. C. M.

† This plan is described under PREVENTION OF SWARMING a few pages further on.

with the one having the queen; then, of course, this plan of bees returning will come to naught. But in a well-regulated apiary of Italians there will be few such occurrences.*

PERFORATED ZINC TO RESTRAIN QUEENS.

Under DRONES, an incident is given in regard to the matter of entrapping the queen when she issues with the swarm. The



A self-hived swarm.

employment of perforated zinc will not prevent swarming—it only hinders the bees from accomplishing their purpose; that is, absconding and taking their queen with them. In other words, the perforated zinc simply takes the place of clipping the queen's wings. In some cases it may be desirable to use the zinc instead of clipping. Usually, from our experience we should deem it preferable to clip the queen's wings rather than to cause the bees the inconvenience of crawling, during the continuance of the honey-flow, through narrow perforations of zinc, simply to hold back the queen should a swarm issue.*

While we recommend clipping in place of using perforated zinc, yet in the case of very strong colonies in the height of the honey-flow, especially when such colonies are in two-story hives, it is more practical to put on entrance-guards or Alley traps. In the first place, attaching the traps can be done in a tenth of the time it takes to find the queen; and in the second place, pulling the hive all apart to find her majesty causes more or less interruption; but of course the queens should be clipped early in the season when it is easy to find them.

THE ALLEY TRAP IN HIVING SWARMS.

When a swarm issues (see cut under DRONES), the bees pass the metal guard readily; but the queen, finding herself shut in, mounts "upstairs" in the same way as the drones. Sometimes, however, instead of going above she will return back into the hive. In five or ten minutes, the bees, discovering the absence of their queen, will go back to the hive. They should not be allowed to make more than one attempt to swarm in this manner, because, after a second failure of the queen to follow she will likely be killed. The bees may, however, cluster without the queen, and remain clustered a short time.

When the queen enters the upper apartment, the entire trap can be detached, fastened to a rake or some other object, and placed among the flying bees. Of course, they will readily cluster about the cage, when they can be hived; but to keep an Alley trap attached to all hives that are likely to send out a swarm during the ensuing ten or twenty days would be rather expensive, both because of the cost of the trap itself, and because of the inconvenience to the laden workers coming home. The same or very nearly equal results can be attained by clipping the queen's wings, at no expense whatever; and at the same

* An apiary of Italians or Carniolans will behave very differently.

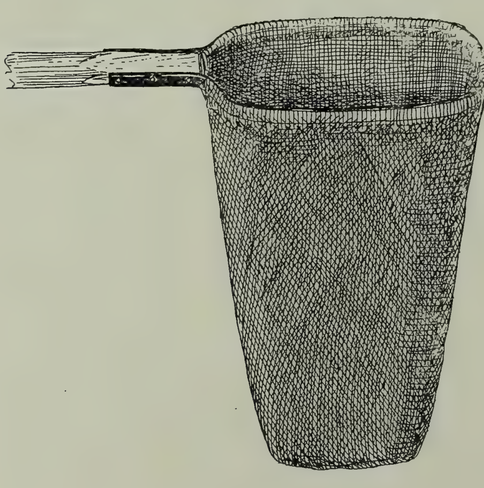
* The danger of the colony suffocating by drones clogging the guards is too great to make it wise to advocate their use. Also the larger and easier the exit the bigger the swarm and the less the liability of "after-swarms."—A. C. M.

time let the bees retain, up to the time of swarming, a free and unobstructed entrance. See DRONES.

SWARMING-DEVICES VARIOUSLY CONSTRUCTED.

Every apiarist engaged in the production of honey should certainly have the wings of *all* his queens clipped. He *can not afford not to,* unless he uses perforated zinc (see DRONES). It is much more difficult to take care of swarms when queens are allowed to go with the swarm. But as there are people who dislike to "disfigure" or "mutilate" their queens, and as some swarms in any case will get out with a virgin queen, we have thought best to describe the various devices for capturing swarms with unclipped queens. See QUEENS, subhead CLIPPING.

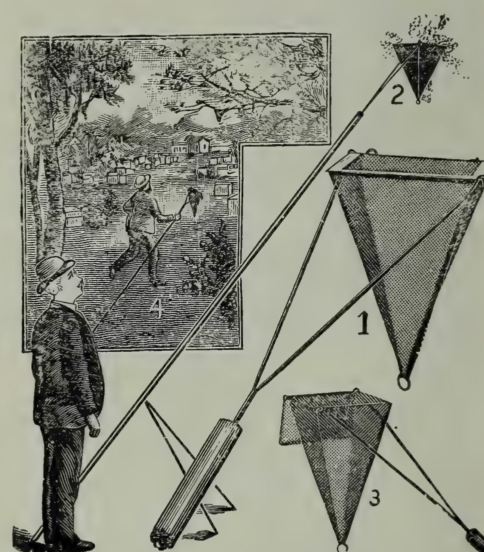
Almost every apiarist has his own peculiar notion as to how a swarming device should be constructed. Some of these implements are very ingenious, and of valuable assistance during the swarming season. Their particular use is to remove a swarm after it has clustered, and place it in the hive where it is desired that it take up a new abode. The first one to which we call attention, not because it is the best, but because it is the simplest, is a sort of butterfly-catcher.



The hoop is made of band iron, and is about 20 inches in diameter. The ends are secured, as shown, to a suitable pole. The bag is to be put up under the swarm, and the hoop is then made to cut off gently the cluster so that the bees will fall into the bag. It is then turned edgewise, so as to confine them while being taken down and carried to the hive. As the bag is made of cheese-cloth, the bees have plenty of air. To empty the bees turn it inside out. The bag has the same diameter as the hoop, and is about four feet long.

A. E. MANUM'S SWARMING-DEVICE.

This consists of a wire-cloth basket made in the shape of an inverted pyramid, and pivoted at the opposite corners so as to hang always in an upright position. When a swarm is captured the basket may be grasped by the ring at the small end, and inverted, dumping the bees into the hive prepared for them.



Manum's swarm-catching device.

Fig. 1 represents the wire-cloth cage or basket; Fig. 2, the device in position, receiving the bees as they cluster on the outside of the cage. Fig. 3 shows the cage open. As soon as the cluster beginning to form is half or nearly completed, run the basket up to and around the cone of bees. An assistant, if present, gives the limb a jar, so as to disengage the bees into the basket. In case no one is ready to assist, a sliding movement will precipitate the cluster into the wire-cloth cage, when it is quickly lowered. This operation, in passing down through the limbs, will usually catch the wire-cloth lid, and close it with a slam. In case it is not closed, the apiarist steps forward and does it himself.

S. D. Chapman, of near Mancelona, Mich., and his method of hiving swarms with a forked pole and a bushel basket.

Half or two-thirds of the bees are generally confined. In all probability the queen is there also. As the bees can not get out, those still flying in the air will very readily cluster on the wire cloth, surrounding the majority of their companions inside. To make this more expeditious the tripod is adjusted and the cage suspended in the air, as shown in Fig. 2, right where the bees are flying thickest. In five or ten minutes the remainder of the bees will be clustered on the outside. At this stage of the proceeding the apiarist comes forward, folds the two short legs against the pole, grasps it at its center of gravity (see Fig. 4), and walks off to the hive, which he has previously prepared. The wire fork is made of steel, and is light and springy. The walking of the apiarist has no tendency to jar the bees off the basket.

One of the special features of the Manum arrangement is that the basket can be adjusted to almost any position, all the way from two to ten feet off the ground. All that is necessary is to spread the tripod legs, catch them into the ground, and leave them standing. In the mean time, unless the hive is already prepared, the apiarist has ample time to get it ready. After this he can return to the swarm just now clustered. Most of the devices require to be held until the cluster has settled. It is a tedious job to hold a pole at arms' length, with face upturned. If the swarm clusters very high, some other arrangement, perhaps, would be better than the Manum; but for moderate heights it's just the thing. The other special feature of the device is, that, after you have gotten about half or two-thirds of the bees into the basket, they can not escape and seek their original point of attachment.

In the absence of any special tools or appliances one can extemporize a swarm-catching device out of the ordinary material at a farm in a very few minutes. Cut a small sapling, long and slender; trim off all the branches, taking care to leave a fork or crotch in the end. This extemporized swarming-pole should be anywhere from 12 to 15 feet long. Next take a common bushel basket and hook it into the fork at the end of the pole, when presto! we have a swarming-outfit almost as good as the one just described, with the further advantage that the basket can be detached from the further end of the pole as soon as the swarm is caught. The operation of catching the swarm is as follows:

After hooking the basket on to the end

Gumbert's apparatus for hiving swarms.

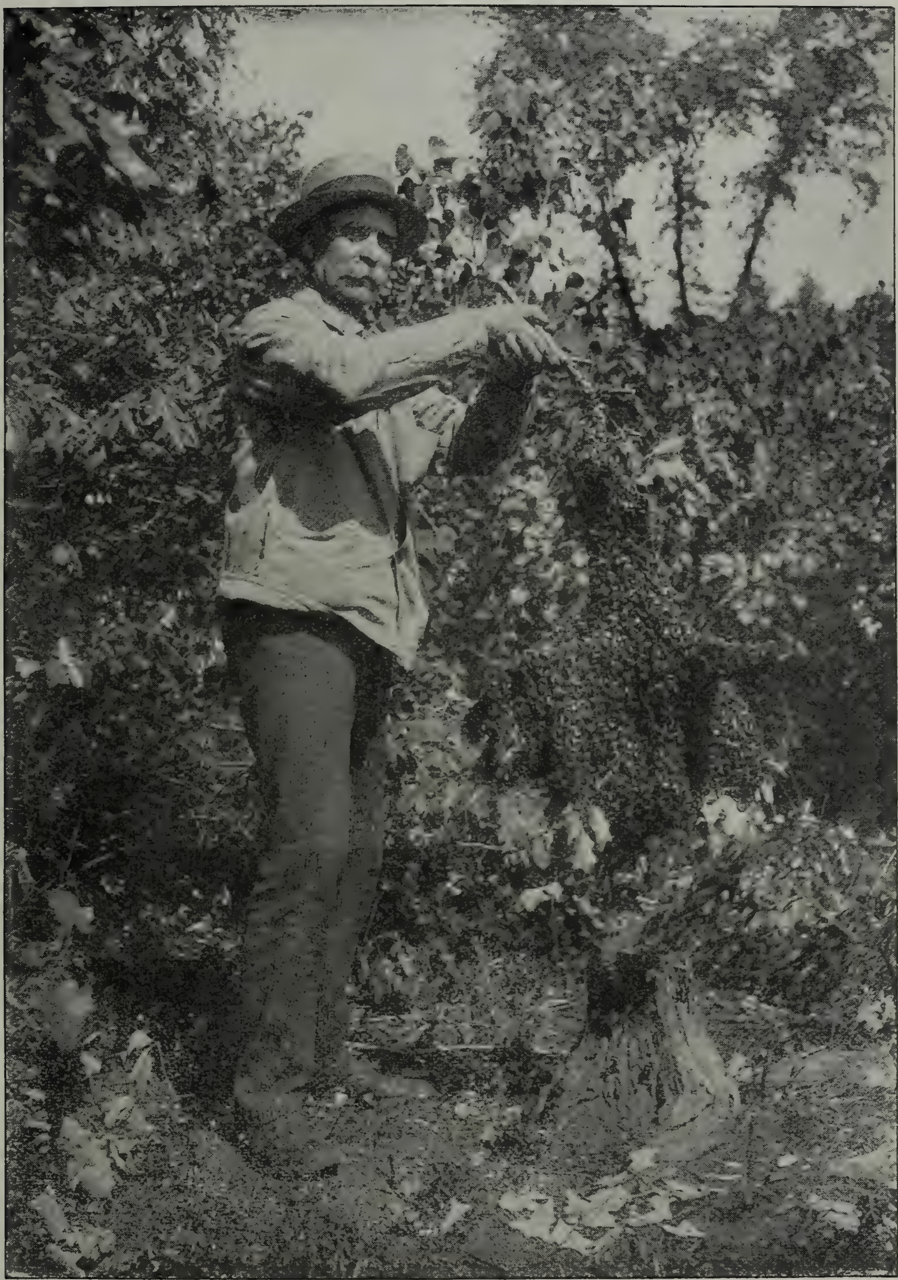
of the pole, elevate the basket to a point just below where the swarm is hanging on the tree. Gradually push it up until the swarm is nicely placed therein. Next give the pole a sharp push upward, taking care not to unhook the basket. This sudden jar will dislodge the swarm; and before the bees have an opportunity to take wing, carefully lower the basket and unhook it from the end of the pole. It may now be dumped in front of the hive where it is to be placed. In all probability a few more bees may cluster back on the old spot. If so, repeat the operation already described, after which place the second bunch of bees where the first was dumped.

THE SWARM-HIVING HOOK.

With most of the hiving-devices we have illustrated, what might be called a hiving-hook can be used to considerable advantage at times. It is simply an iron hook large enough to compass an ordinary limb on which swarms cluster, mounted on the end of a long pole, and resembling, somewhat, a shepherd's crook. One of the hiving-devices is passed beneath the swarm. This hook can be used to reach over, grasp the limb on which the swarm is clustered, and by one or two smart jerks jar the bees into the basket, bag, or box, as the case may be.

Swarms usually alight low, so the ordinary hiving-apparatus and tools previously described can reach them from the ground.

But there are times when they will settle on pretty high limbs. It is then that a ladder is called into requisition. If it will not reach the swarm it can at least land the climber among the upper limbs, so that he can step from one limb to



Two swarms united in one.

another, and finally reach the bees. But it is difficult to stand an ordinary ladder against a limb of a tree so that it will be secure for climbing, on account of the unevenness of the branches. A foreigner by the name of R. Strimpl, of Seltzschau, Bohemia, sent us a drawing of a ladder that can be lodged—that is, the upper part of it—securely on some limb above. The engraving shows its principle of application.

The two side feet, or forks, prevent the ladder from revolving, while it will be observed that the ladder terminates in a single pole, which may be very easily lodged in the fork of a limb, where a two-pronged ladder can not. The three prongs below the ladder are sharpened at the end, and securely pushed into the ground. The perfect lodgment of the other end in the crotch of the limb makes the ladder a safe means

of ascent. Aside from this it will be lighter. But it is more desirable to prevent swarms from going beyond our reach —at least clustering on elevated limbs.

HOW TO GET A SWARM FROM AN INACCESSIBLE LIMB.

Sometimes a swarm will alight upon a limb beyond the reach of any ladder. Possibly, also, the limb upon which the bees are clustered is so far out from the body of the tree that it would not sustain the weight of any one climbing after them. Such a swarm can usually be reached in

This swarm of bees issued June 7 from a colony of bees that produced 180 pounds of comb honey the same season.

the following manner: Secure a ball of good strong twine, and tie on the end of it a stone about as large as the single fist. If you are not a good thrower yourself, get some boy who is a good ball-player to perform the throwing act. Uncoil a considerable quantity of the line, then throw the stone into a crotch if one is near the swarm. If you are lucky enough to land the stone in the right place, right in the crotch, draw gently on the line until the stone catches in the fork of the crotch. Give one quick jerk to dislodge the bees and after that keep the limb in a tremble until the bees cluster on some other spot which they will do presently if the limb is kept agitated for five or ten minutes. They may cluster higher up, but the probabilities are they will seek some other spot more accessible.

If there is no convenient crotch at the right point, throw the stone so it will pass over the limb, taking about one foot of line; then give the string a good jerk, causing the stone with the line to whirl around the limb a couple of times. If you do not succeed in doing this the first time or two, a third or fourth attempt may be successful. It is not a very difficult trick; but the main thing is to get the line attached to the limb at some point near the swarm. Then the rest is easy.

SPRAY-PUMP FOR CONTROLLING SWARMS WHILE IN THE AIR.

One of the most useful implements in the apiary during the swarming-time is a good hand force-pump. A swarm of bees in the air with a queen that might otherwise circle about for fifteen or twenty minutes, can usually be made to cluster in from two to five minutes by its use. Whether the fine particles of water dampen the wings, and so impede their flight, or cause the bees to think it is raining, or both, and that therefore they had better cluster at once, we can not say; but certainly the spray has a very decided effect. One who becomes moderately expert will be able not only to make the bees settle but to *compel* them to cluster on some point easily accessible to any of the ordinary hiving-devices just described. Occasionally a swarm will make for the top of a tall tree. With the pump we head them off, causing them to settle on a lower branch. Even when a swarm is clustered twenty or thirty feet from the ground, by adjusting the stream nozzle and letting it play directly on the swarm itself, we can, very many times, dislodge them thus, causing them to take wing and finally settle again upon a lower point of attachment. Again, several swarms will come out simultaneously, and two or more at-

Limb of a tree cut off with the swarm ready to hive.

tempt to cluster together. By the timely use of the spray, each swarm can be kept separate by dampening the wings of the stragglers of the two swarms about to come together. A good many times a swarm that is about to abscond can be headed off and made to cluster; in fact, our boys, during the summer of 1889, would drive a swarm about like a flock of sheep. It is very annoying and inconvenient to have a swarm pass from our premises over to those of a neighbor. During the summer of 1889 we had something like eight or ten swarms come out every day for nearly a week, and yet in only one or two cases did they leave the immediate vicinity of the apiary; and had it not been for the pump we should, in all probability, have had to chase all over the neighborhood, to say nothing about climbing tall trees.*

After a swarm begins to cluster on a desirable spot, stop spraying in that direction. Retreat, and drive the stragglers toward it, but be careful not to spray the place where they are clustering. As a general rule, two or three small clusters will be forming at once. Spray the undesirable ones, and keep them sprayed until these points of attachment are abandoned.

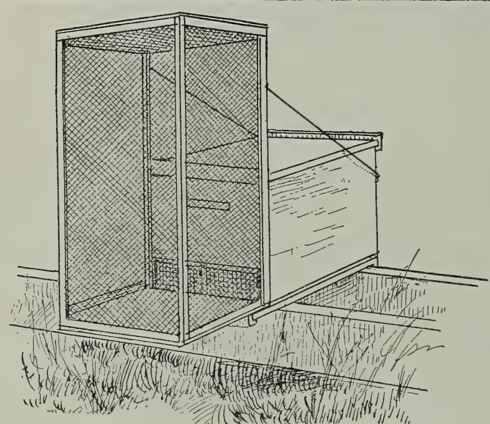
During the swarming-season it is a good idea to keep several barrels of water in and around the immediate vicinity of the apiary, so as to have the same handy. If you must run to the pump every time you need

* We didn't then clip the wings of our queens as we now do, hence that chasing is now dispensed with.

a pail of water, the swarm may get away from you, or cluster in the top of a tall tree.

SWARM-CATCHER.

This is simply a large wire-cloth cage, in the shape of an oblong box, about three or four feet high, by 12 or 15 inches square, one end being open, and made to fit against an ordinary hive-front.



Swarm-catcher.

It very often happens that the apiarist is on hand just at the time the swarm pours out the entrance like hot shot. Well, with one of these swarm-catchers handy he simply attaches the mouth to the entrance, and the outpouring bees fly pell-mell into the top of the cage, and are there confined. When the apiarist succeeds in catching two-thirds of the bees, the rest will cluster on the outside. Then the cage is set very near where the bees come forth, mouth end down. Meanwhile he prepares his hive, if he has not already done so, and then brings the cage of bees and dumps them right into the hive, replaces the cover, and the swarm is hived without having had any swarm in the air—no, not even giving them a ghost of a chance to fly all over the neighborhood, and possibly finally alight upon the limb of a tree 40 feet from the ground. But it should be borne in mind that the swarm-catcher is serviceable only when the apiarist happens to be on the ground just as the bees are beginning to pour forth.

We consider a large cage that comes down over the whole hive much better than something adjusted to the entrance, as shown above. The one shown in the half-tone, under ROBBING, is more quickly applied, because it can be clapped down over the hive and stop proceedings instanter. As soon as the bees are all out, lift up the cage gently, and carry it to the hive where you propose to dump the swarm. Hold the cage squarely over the prepared hive with its cover off, and give it one quick jounce. This will dislodge the bees so that most of them will land in and around the hive. As soon as they have settled, remove the cage and put on the cover.

THE AUTOMATIC HIVING OF SWARMS.

For many years back there has been an effort on the part of beekeepers of an inventive turn of mind to get up an arrangement that would automatically hive swarms in the absence of an apiarist or attendant; and since out-apiaries have begun to assume such importance where the production of honey is carried on extensively, some sort of device that will hive automatically the swarms—yes, do the work just as well as if the apiarist were present himself is something greatly to be desired. A great many devices have been introduced; but most of them have been proven to be more or less a failure.

The general plan contemplates some scheme having an empty hive placed near the colony expected to swarm. This empty hive may be alongside, in front, or below the other one. In the case of the first-mentioned plan, an entrance-guard is placed in front of each hive; and connecting the two is a tube of wire cloth or perforated zinc. When the swarm comes forth, the queen, finding herself barred by the perforated metal, runs along until she finds the tube communicating with the entrance-guard of the other hive. In this tube she runs up against a bee-escape or wire-cloth cone. She passes this; but, being unable to return, is compelled to enter the entrance-guard of the new hive. Upon discovering that the queen is not with them, the bees rush back to the old stand; a part of them find the queen in front of the new hive, enter with the queen and "set up housekeeping." But the plan fails, because the majority fail to find her, and re-enter the parent colony.

We have tried these plans to some extent, but, taking every thing into consideration, consider it cheaper and more practicable to hive the swarm on the clipped-

wing plan, or, better, practice brushed swarming, as described further on.

HOW TO HIVE SWARMS WITHOUT SPECIAL DEVICES.

If the apiary is located in a locality where there are no tall trees, but only low-growing shrubbery, or, at most, dwarf

Carrying a captured swarm on a bicycle.

fruit-trees, or, better still, if the wings of all queens are clipped, the special tools we have already described will not be found absolutely necessary, and perhaps not even a convenience, if we except Manum's arrangement. Our own apiary, illustrated in connection with some of the factory engravings shown in the picture-gallery at the close of this work, you will notice contained no trees. Outskirting it are rows of bushy evergreens furnishing absolutely the only place for the bees to cluster in the immediate vicinity of the apiary besides grapevines in the apiary itself. Rarely do we have swarms clustering elsewhere. When a swarm alights on one of the two places just mentioned we select a frame of unsealed larvæ. As the swarm is but rarely more than four or five feet from the ground, this frame is gently thrust among the bees. A large majority of them will very soon crawl upon the frame. This together with the adhering bees is placed in a hive in company with three or four frames immediately under where the swarm is clustered, if possible. The limb on which the cluster is hanging is jarred, causing the bees to fall on the frames below. Those bees which have already clustered on the frames will begin to call their companions. The hive is then left until the bees have all entered, then they are removed to their permanent location in the apiary before they have had time to fix a location.

You will scarcely appreciate the absence of large trees and the presence of small undergrowth until you have had an apiary so placed whereby swarming has not half the terrors to the beekeeper as where the clusters are just as likely as not to attach themselves to high positions.

The method we have just described applies when the queen's wings are not clipped, either because we do not wish to mutilate her fair proportions or because she happens to be young. Wisely, a great many apiarists prefer to clip their queens' wings. Perhaps we might say a majority do so, because it saves the use of expensive tools, tree-climbing, and, to a great extent, prevents swarms uniting.

HOW TO BRING HOME A SWARM A MILE OR SO FROM THE APIARY.

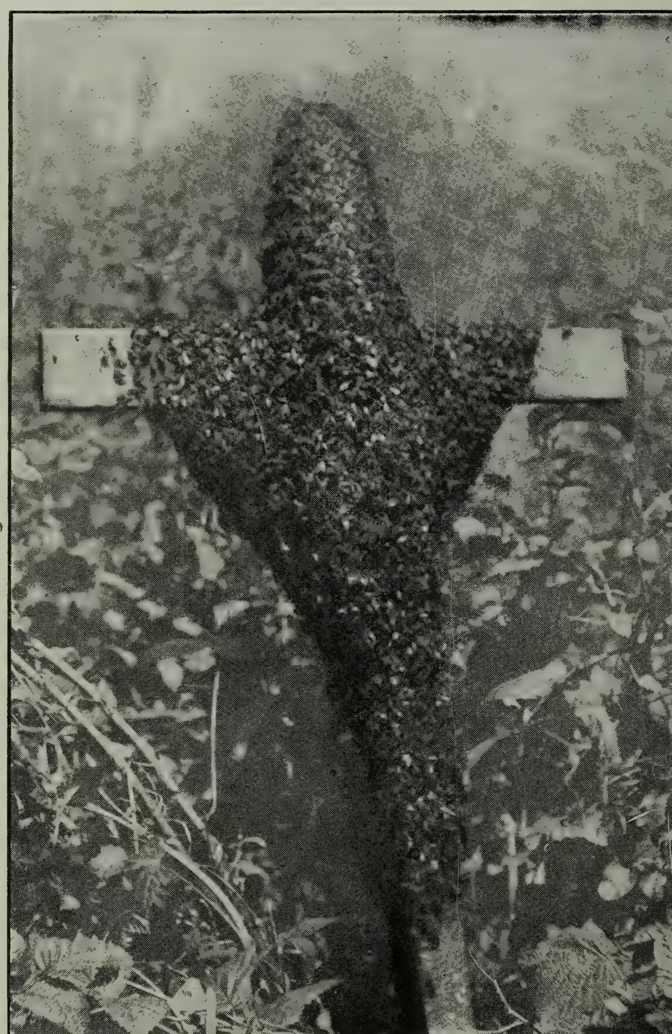
A swarm will sometimes escape and be traced a mile or so from the bee-yard. At other times a farmer will report that a swarm of bees is hanging to one of his trees, and that, if the bee-man will come and hive them, he can have them. A good swarm is always worth going after; but how shall it be brought back with the least expenditure of time when bees are swarming at home? At our apiary we have been in the habit of sending one of our yard-men on a bicycle, equipped with a burlap sack, a pair of pruning-shears and a smoker, these latter fastened to the rider. The bicycle enables him to make a quick trip, and on arrival the bag is quietly slipped around the cluster of bees, if attached to a limb of a tree,

and tied. The pruning-shears cut the limb, when the bag and all is slung over the handle-bars, or carried in one hand while the other guides the machine home.

PLURAL SWARMS UNITING.

When the swarming-note is heard in the apiary it seems to carry with it an infection. In no other way can we account for swarms issuing one after another while the first is in the air, unless they hear the sound and hasten to go and do likewise. Of course, they will all unite in one, and as many as a dozen have been known to come out in this way and go to the woods before any thing could be done to stop them. If your queens are clipped, and you "hustle around" and get them all in cages deposited in front of the hives, they usually separate and each bee goes where it belongs. Unless employing plenty of help you will be unable to get the hives all moved away and a new hive fixed for each one before they come back. In this case they will return to their old hive, and, if the queen is released, will sometimes go to work; but more often swarm out again within a few hours, or the next day. If you keep putting them back they will soon attack and kill their queen, then loaf about until they can rear a new one and swarm again. This is very poor policy, and we can by no means afford to have such work. If they swarmed for want of room, they go to work all right, after having room given them. If they come out the second time, we should give them a new location, or do something to satisfy their natural craving for starting a new colony, otherwise they may loaf, even if they do not try to swarm again.

To go back: Suppose they get a queen or queens having wings, and cluster in one large body. In this case you should scoop off bees from the cluster with the swarming-bag, a tin pan, or a dipper, as may be most convenient, and apportion parts made about as nearly of the size of a swarm as may be, about in different hives. Give each hive a comb containing eggs and larvæ as before, and then get a queen for



A cross of bees that are not cross.

each one if you can. In dividing them up, should you get two or more queens in a hive they will be balled as we have before described, and you can thus easily find them. Where more than one queen is in a hive, you will find a ball of bees, perhaps

the size of a walnut or hen's egg, about them, and this can be carried to the colony having none. When you can not tell at once which are queenless, you will be able to do so in a few hours by the queen-cells they have started. If you are more anxious for honey than bees, you may allow two swarms to work together; and if given sufficient room you will probably get a large crop of honey from them; but this plan does not pay, as a general thing, because the extra bees will soon die off by old age, and your colony remains no larger than where the queen retains only her ordinary number of bees.

PREVENTION OF SWARMING.

This subject is a mooted one, and some of our best and most experienced beekeepers confess they have been baffled in their efforts to confine swarming within reasonable limits.* Usually it is not desirable to prevent first swarms. Second swarms or after-swarms are the ones we should *like* to control. Some prominent beekeepers practice cutting out all queen-cells but one eight days after the issue of the first swarm; that is, they allow all the unsealed larvæ to become capped over, leaving no opportunity for further building of cells. If only one cell is left in the hive, of course only one queen can be hatched and reared. If she is successfully fertilized the colony will generally settle down to business. Excessive swarming is often induced by a number of young queens being allowed to mature about the same time. These unfertile queens will be pretty apt to keep up swarming in the hive so long as there is a surplus of queens. See After-swarms.

If we can entirely prevent swarming, and keep the bees at home storing honey all the season, we sometimes get a large crop from a single hive. Whether we shall get more in that way than from the old stock and all the increase, where swarming and after-swarming is allowed, is a matter as yet hardly decided. Should a swarm come out in May, and the young queens get to laying in their hives by the first of June, their workers would be ready for the basswood-bloom in July, and it is very likely that the workers from three queens would gather more honey than those from the old queen alone. But another point is to be considered. The two or three new colonies must have stores for winter; and as it takes from 25 to 50 lbs. to carry a colony through until honey comes again, this amount would be saved by the prevention of swarming. Where one has plenty of bees, and desires honey rather than increase, a non-swarming apiary becomes quite desirable.

* See Bee Behavior.—A. C. M.

PREVENTION OF SWARMING BY CAGING OR REMOVING THE QUEEN.

Hetherington, Elwood, and some others, have practiced caging or removing the queen during the honey harvest. Of course, no swarm will issue regularly where no queen is in the hive; and if no cells are allowed to hatch, prevention is accomplished. When the harvest has commenced, before giving the bees a chance to swarm, the queen is caged in the hive, or, perhaps, preferably given to a nucleus. If queen-cells are not already started they certainly will be on removal of the queen; and if the queen is caged they will just as certainly be started in a short time. In any case they must be cut out before there is any danger of the queen hatching. If all the cells are destroyed at the time of removing the queen, then a second time, eight days later, and a third time eight days later still, there will be no possibility of any swarming. The advocates of this plan claim that the bees that could be raised from eggs laid during the time the queen is caged or removed would be too late for service in gathering harvest, hence only consumers.

On the other hand, there are those who question whether the bees work just as industriously without a laying queen in the hive. One difficulty about the plan is, that it is almost impossible to be sure that no queen-cell has been missed to give rise to very undesirable complications.

GIVING PLENTY OF ROOM, AND RUNNING FOR EXTRACTED HONEY.

Many times bees will swarm because the apartment for brood-rearing is limited. Contraction and the queen-excluding honey-board give the queen only a limited amount of room, with swarming as the consequence. For this reason it is desirable not to reduce the brood-chamber too much. But whether contraction is practiced or not, the

fever may be greatly allayed, and perhaps prevented altogether, by giving an abundance of surplus room on the plan of tiering up. Do not let the colony at any time feel crowded for space. Judicious tiering up, as described under COMB HONEY, will not only secure more honey, but it will largely discourage natural increase when not desired. When running for extracted honey the problem is much easier. Mr. N. E. France, of Platteville, Wis., who produces enormous crops of honey, says he is troubled very little with excessive swarming. He does not practice contraction, but allows the queen and bees plenty of room. If the queen desires to go above, she is allowed that privilege. Messrs. C. P. Dadant & Son keep about 500 colonies in large Quinby hives. These hives being so large, the bees are but little inclined to swarm. In fact, Mr. Dadant says, in the *American Bee Journal*, page 311, Vol. XXV., "For more than fifteen years we have dispensed with watching the bees of our home apiary, numbering from 80 to 100 colonies. As the yearly number of natural swarms does not exceed two or three, the expense of such watching would be far above the profit." While combs or foundation tend to prevent if not discourage swarming altogether, for other reasons other beekeepers seem to prefer smaller sizes, such as the Langstroth. See Dadant hive, under HIVES.

For particulars on how to prevent swarming by shake swarming, see ARTIFICIAL SWARMING.

CONTROL OF SWARMING BY MEANS OF LARGE OR PLURAL ENTRANCES.

When we see colonies clustered out at the beginning of a honey-flow, there is a lack of room, a too contracted entrance, or both. A colony that hangs out day after day when there is a light flow of honey is almost sure to start cell-building; for bees will swarm much worse during a light or moderate yield than when it is heavy.

If bees have been hanging out for perhaps a week, in all probability there will be queen-cells with eggs or larvæ in them. The thought of swarming seems to be in the mind of the colony. While the cells may be cut out and delay the swarm, it is advisable also to enlarge the entrance and give room. Far better still is it to provide an ample entrance *before* the bees cluster out at all in the first place; and before they feel cramped for room they should be given extra super capacity. We have often made colonies that were clustering out go into the hives by simply enlarging the entrances and giving room. Other colonies that are given large entrances will often

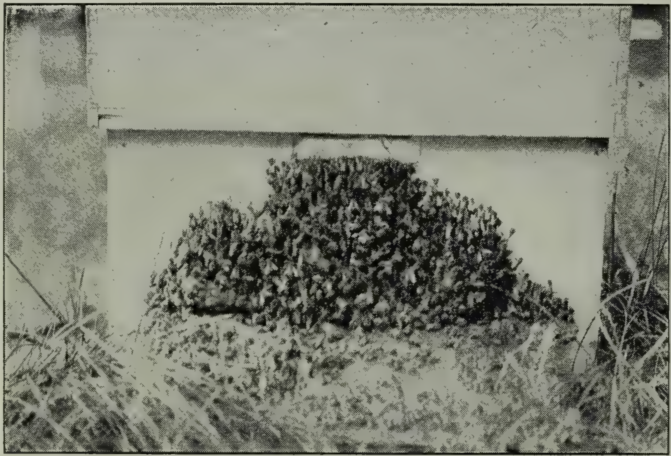


FIG. 1.—A case of too small an entrance. It was a warm day when this picture was taken. The bees, being unable to ventilate through the small entrance (8 x ¾ in.) clustered out.

FIG. 2.—A hive with proper ventilation at the bottom to prevent clustering out at the entrance.

never start cells nor prepare to swarm. We are satisfied, from experiments that we have been conducting, that swarming can be brought very much under control, if not entirely prevented before the swarming idea gets into the mind of the colony, by enlarging the entrances or giving plural entrances and room.

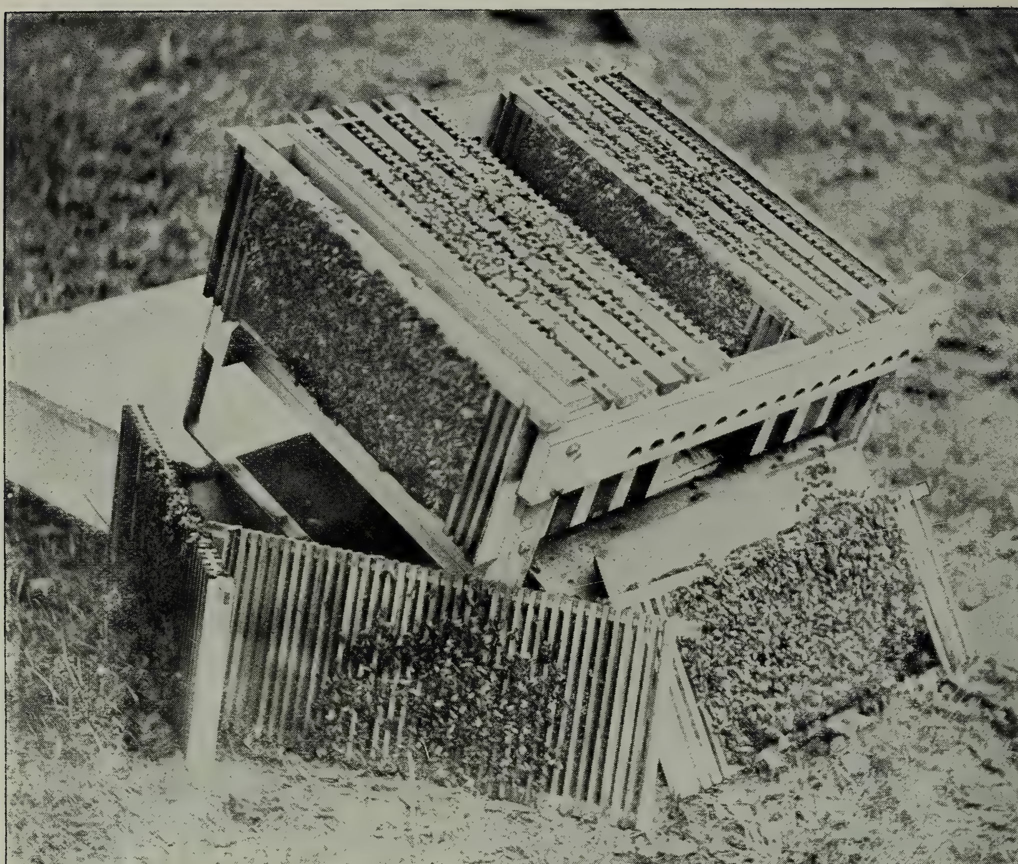
The ordinary double-walled or chaff hive will not give that degree of entrance enlargement that is always desirable. While it has been made to provide a maximum of one inch by the inside width of the hive, yet there come times when a much larger amount of ventilation should be provided.

Dr. Miller and other prominent beekeepers have for years been raising their hives up on four blocks so that there are really four entrances, back and sides as well as in front. Our neighbor Vernon Burt, of Mallet Creek, has for some time practiced this plan, and he says it so nearly eliminates swarming that he has almost none at all.

Fig. 2 shows the front of one of his hives with its easy slanting approach to the main entrance in front, while the larger view, Fig. 3, shows how the bees are utilizing the rear and sides for flight, as well as the front. We visited his yard a couple of times in the midst of the swarming season. Not on a single hive in the yard of something like 200 colonies was there a case where the bees were clustered out in front. They were flying merrily, and very much at work. Contrary to what Dr. Miller reports, we observed that they were utilizing the back and side entrances as well as the main entrance, although it was easy to be seen that the latter was used more frequently than any of the other three. In Fig. 3 the camera caught a number of bees just ready to take wing at these side and end openings, for the bees were flying quite freely from all sides of the hive.

FIG. 3.—One of Vernon Burt's hives for the production of comb honey. Mr. Burt says this scheme of putting his brood-bodies upon four blocks so as to provide entrances for all four sides goes a long way toward eliminating swarming.

Of course, merely raising the hives up on four blocks alone will not prevent swarming. The bees must be given plenty of room *before* swarming-cells are started. They should also be given a reasonable amount of shade. In Fig. 3 one will see



Aspinwall hive dissected, showing brood-frames and slatted dividers.

that Mr. Burt has some old telescope covers that he formerly used on double-walled chaff hives. These are a good deal larger than the present hives, and, when placed over the supers, they project on the front and rear, and on the sides enough to give a reasonable amount of shade. In the middle of the day the hive is fairly well shaded.

Further particulars on the subject of entrances, and their relation to the prevention of swarming, will be found under the head of ENTRANCES.

NON-SWARMING HIVES.

All the systems thus far described, both under this heading and under the head of "Artificial Swarming for the Prevention of Swarming," relate to methods of management of the hives or colonies themselves. For a number of years we have heard a great deal about non-swarming hives. Within the last two or three years some progress has been made; but how far these various non-swarming hives are going to prove to be a success we are not able to say; but the inventors or promoters of these new devices seem to be confident that they are going to be able to control the nuisance of swarming through a special construction of the hive itself.

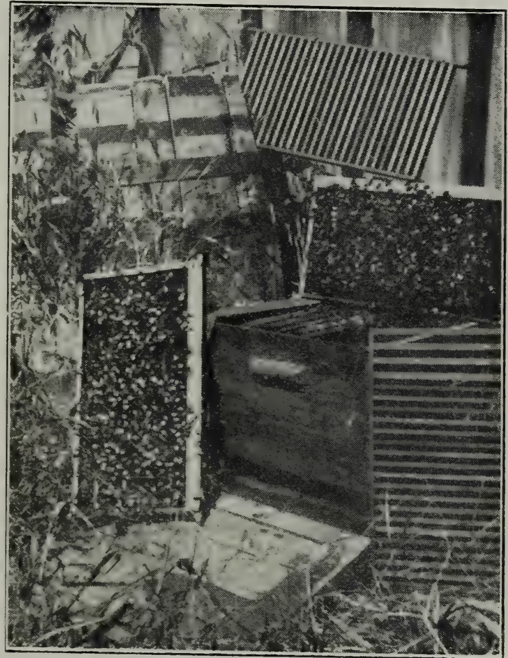
Before we describe these various non-swarming hives or devices to be attached to ordinary hives, it will, perhaps, be proper to recapitulate the causes of swarming; and, knowing the causes, we can better understand the principles governing construction of these devices. The first and primary cause is a crowded condition of the hive. This may be because the hive is too small to accommodate an ordinary colony, or because the colony is too large to be accommodated in an ordinary hive. Overcrowding obstructs ventilation, and some claim that a lack of ventilation, or too many bees in the hives, overheats the brood. A large amount of brood in all stages of growth, and a large force of

bees, a crowded condition of the hive, too small an entrance (and this means insufficient ventilation), is almost sure to induce swarming when other conditions are favorable. We can enlarge the hive by putting on extra supers. We can increase the amount of ventilation by enlarging the entrance or by placing the hive on four blocks, as already described; but even when one or both of these means of prevention have been applied, swarming is not entirely overcome.

Mr. L. A. Aspinwall goes at the problem by increasing the clustering space between the combs during swarming. To that end he devised a hive consisting of a series of brood-frames, and during the swarming season a series of slatted wooden dummies or separators placed in alternation between the frames. These slatted dummies made up of quarter-inch vertical slats spaced a bee space apart provide a clustering space between the brood-combs, thus relieving the congestion that naturally arises because a large force of bees can not be crowded into the small space between the combs such as we find in an ordinary hive. The Aspinwall frames, instead of having one end-bar, have a series of extra end-bars bee-spaced apart that provide a clustering-space at the ends of the frames as well as between them. The supers are constructed in much the same way as the brood nest. The end-bars of the frames themselves, being closed-end and close-fitting, constitute the ends of the hive proper, the frames simply resting on the cross-cleats. The sides are closed up by means of wooden panels that hang like the frames on the frame-supports.

It has been claimed that there will be little or no clustering at the entrance of the hive, because the surplus bees will be clustered in the dummies between the frames; and as the dummies consist of a series of slats a bee-space apart, there can be no comb-building in the space they occupy. Mr. Aspinwall has tried out this principle, and it has worked so well in his hands that he thinks he has solved the problem of a non-swarming hive. But there have been some reports showing that it failed in the hands of others. The chief objection to the hive is expense.

The question would naturally arise why slatted dummies could not be put in between the frames of an ordinary hive, thus providing a clustering-space between the frames, the same as in the Aspinwall hive. This would of course require an extra hive body or super to accommodate an extra lot of frames and dummies. Mr. A. B. Small, of North Topeka, Kansas, tried out the principle, and believes it will work.

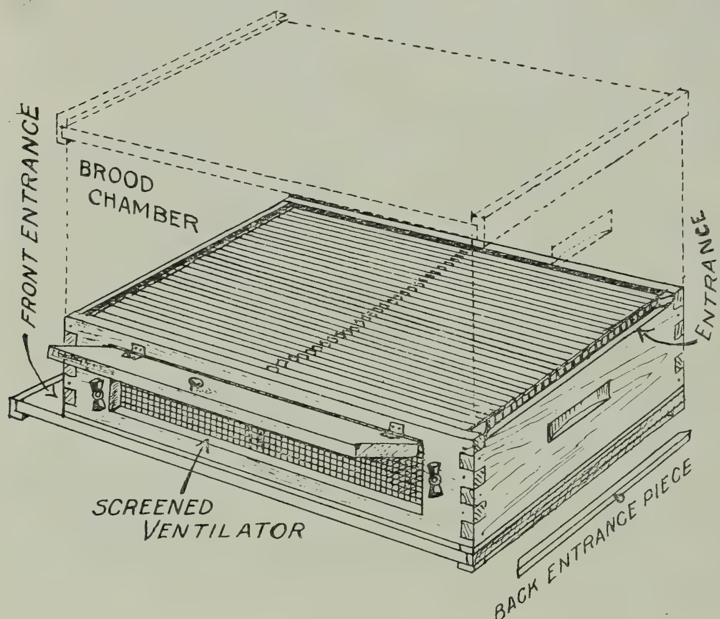


Dividers like those used in the Aspinwall hive used in a double-story ten-frame hive, ordinary construction.

The illustration shows an ordinary hive with slatted dummies; but Mr. Aspinwall claims that it will not eliminate swarming.

There are others who tried the principle of making a clustering-space formed of a series of dummies a bee space apart under an ordinary hive or in front of it. The accompanying illustration shows the principle that has been adopted by Mr. Junge and Mr. Pierce. It will be noticed that it consists of an ordinary super having ventilating sides covered with wire cloth and shutters, and a detachable entrance strip at the upper back end. This super in filled with ordinary fences such as are used in a comb-honey super. These fences are so constructed as to provide a series of slats and bee-spaces where the bees can build no comb, and at the same time provide a large amount of clustering-room between the brood-nest proper and the bottom-board with its entrance beneath.

Both Mr. Junge and Mr. Pierce feel that this non-swarming attachment, when rightly applied, will discourage if not altogether stop swarming. But they insist that it must be placed under the hive before the swarming fever has gotten under way. The removable cleats at the upper back entrance may be removed during very warm weather to provide additional ventilation after the side doors are opened.



The Junge-Peirce non-swarming attachment.

We have not tried these various devices; but perhaps our readers may be in position to give them a test and report to us.

DECOY HIVES.

Many beekeepers have followed out the idea given on page 1 (Do bees choose a location before swarming?), by locating hives in the forests, in the trees, and such hives have in many cases been quickly accepted and appropriated. We are indebted to the late Mr. John H. Martin for first suggesting to us the idea. Hives left standing on the ground in the apiary have many times been selected by swarms, and, if we are correct, the bees, in such cases, often come out of the parent colony, and go directly to these hives without clustering at all.

SWARMING, ARTIFICIAL.—See ARTIFICIAL SWARMING; also INCREASE, and NUCLEUS.

SWEET CLOVER.—This is one of the most important honey-plants in the world. Widely distributed all over the United States, it is becoming more and more abundant. While it does not yield any surplus in the East except in limited areas, the bees are always busy on it when in bloom, which is from the close of white clover clear on up to fall. It is therefore invaluable for brood rearing, particularly as the beekeeper can depend on it every year, wet or dry. In the West, carloads of almost pure sweet-clover honey are produced. We say "almost pure" because there are other plants usually in bloom at the same time. This very fact makes it more salable, because a strictly pure sweet-clover honey is a little too strong, and a slight admixture of other honey improves it very much. Conversely, a little sweet clover in any other honey adds a quality or flavor that is very delightful. For that reason bottlers of honey like to get it to mix with other honey. Taking it all in all, sweet-clover honey will always have good demand as a blender. This will be better understood when it is stated that cumarin, a substitute for vanilla, is extracted from the sweet-clover plant. It is this vanilla flavor in sweet-clover honey that makes it so desirable for blending purposes.

There are two kinds or species of sweet clover—the white and the yellow.

WHITE SWEET CLOVER (*Melilotus alba* Desv.).—Also called white Bokhara, white melilot, honey lotus, and tree clover. Introduced from Europe, and now naturalized in nearly all parts of the country. Throughout the East it grows in both cultivated and waste places.

YELLOW SWEET CLOVER (*Melilotus officinalis* L. Lam.).—Other common names are yellow melilot, balsam flowers, and king's clover. This species, which is also found

in Europe and Asia, extends over the same area as white sweet clover, but is less common. In Texas, according to Scholl, the honey is regarded as superior to that of white sweet clover. In California it occurs in the central portion of the State around Sacramento, where it yields a pleasant-flavored, amber-colored honey. Indian yellow clover, or sour clover (*Melilotus Indica* L. Lam.), which was introduced in ballast, and is becoming common in parts of the far West, has smaller yellow flowers.

SWEET CLOVER NOT A NOXIOUS WEED; HOW IT PROPAGATES.

Within the last few years sweet clover, commonly called a weed by town councils and by ignorant farmers, is finding its way over the entire United States. We can remember a few years ago when a plant of sweet clover was unknown around here. The first few stalks that we ever saw created quite a sensation, both on the part of the beekeeper and of the general public, because, during the time they were in bloom, they were fairly covered with bees. So far from being a noxious weed it is really a valuable forage-plant in some localities; and while white clover (see CLOVER, sub-head "White Clover") is not yielding as it did some years ago, *sweet* clover, a wonderful honey-plant, seems determined to make up for the loss by spreading from one end of the country to the other. It takes special delight in growing on waste places, even on the hardest and roughest clay, along common wagon-roads and railroads. It is scattered over the former by being carried on the wheels of wagons when the roads are muddy, and, as a consequence, the plants may be found along most of the highways of the country. On the steam roads the rapidly moving trains, by reason of the great suction generated, gather up the seeds and drop them along their journey, with the result that the seed is scattered by the cars from one end of the country to the other; but it never occupies any good arable fields of the farmer, for it is very easily exterminated. From the very fact that it will grow in waste places where nothing else could eke out a living, we can say that it is really adding to the wealth of the country. In some localities it affords the only forage-plant that will grow, and as such is very valuable. In other localities where it grows by the roadsides and along railroad tracks, it furnishes a little honey to the bees during that time of the year when no nectar can be obtained from any other source; and if it were grown in great patches instead of in streaks a mile or a hundred miles long it would be much more important as a honey-plant; because bees do not ordinarily fly much more than one or two miles, the amount of acreage of the plant within range of their flight is very limited.

The following by E. E. Barton, published by Bokhara Seed Co., of Falmouth, Ky., is so instructive and valuable, that we have secured permission to publish it entire:

INTRODUCTION.

The object of this circular is to present the subject of sweet clover in a plain practical way; and omitting technical and scientific terms, it is addressed in plain language to our farmers and land owners who are interested in hay and pasturage, and in restoring the fertility of the soil and maintaining it in a condition to supply the increasing wants of man and the domestic animals.

It is intended to convey some information and a few useful suggestions on a subject about which there has been very little written of an authoritative character, and about which there is some confusion, a little prejudice, and much misinformation. More could be written here on forage crops, seed, sowing, soils, and their preparation for sowing, but it is desired to keep within the limits of a few pages only.

What is said here about growing sweet clover applies only to the white and the biennial yellow kinds, which are the only ones that will concern the practical farmer and to conditions of climate, etc., existing in Pendleton County (in Northern Kentucky), where the author has had much experience and success for a number of years in growing these varieties. Sowing seed north or south of here should be timed to suit the differences in temperature and season.

DESCRIPTION.

Sweet clover, as with red clover, alfalfa, the beans, peas, and numerous other kindred species, belongs to the family of plants called legumes, a group of whose importance to agriculture is beginning to be recognized more and more the world over, and furnishes in a large measure the food supply of both man and beast, as well as constituting the mainstay of the soil's fertility.

Although sweet clover is called a clover, it is not strictly such, it and alfalfa and the clovers being classed as separate and distinct branches of the legume family. Instead of being like the clovers, sweet clover is more nearly akin to alfalfa, resembling it very closely in appearance, habits of growth, and food content or nutritive value, which, together with their similarity in origin and history, as well as having the same species of root bacteria, would almost lead one to believe that sweet clover and alfalfa might be variations descended from what was one time the same parental species. This seems the more probable when it is considered that the two had a common habitat in their early history, from Northwest India to the Mediterranean Sea, and that among the numerous species of cultivated and wild alfalfa there were yellow, blue, and perhaps white flowered plants, the same as with the sweet clovers.

Sweet clover is very hardy, makes a rank growth of stems, leaves, and roots, but is not persistent, as

An acre and a half sowed to sweet clover in 1906, which has been allowed to reseed itself each year; the average height is now from 7 to 9 feet.

it may be killed easily by mowing when in bloom. If allowed to mature it will reseed itself abundantly, even when pastured, and continue like a perennial from year to year, as long as wanted, without sowing again. It thrives in a variety of soils, growing well in almost pure sand, in silt, loam, and hard, rocky, and decidedly poor clay soils. It also grows on hills, bottomlands, in well-drained and in wet soils, and in alkaline and non-alkaline soils. It adapts itself to almost all conditions of climate, withstanding the cold winters and hard freezes of our Northwestern States and Canada, the long hot summers of the South and the drouth of the western plains. The long deep taproot enables it to obtain moisture in times of drouth, and prevents winter killing, or lifting out with the freezes.

Sweet clover obtains its name from a strong, distinct sweetish fragrance of the flowers; also of the plant when drying, which is due to an ethereal oil it possesses called "cumarin." Sweet clover is used for hay, pasture, and green manure, as well as fertilizing and renovating old, poor, and thin soils. There are four principal kinds, namely, white, biennial yellow, Indian or annual yellow, and blue.

THE WHITE SWEET CLOVER.

White sweet clover, so named from its white flowers, is also called bokhara, honey-lotus, tree-clover, and giant alfalfa. It is a native of the elevated and arid regions of Asia, and is generally called Bokhara clover because it is supposed to have originated in a country of that name in Central Asia, situated just west of Chinese Turkistan and east of the trans-Caspian territory of Russia, consisting principally of desert and mountain ranges, devoted largely to raising goats, sheep, and cattle, and possessing a climate of unusual severity, of cold in winter, and heat and drouth in summer. From there it was taken to Persia and Greece, and then to Rome, from whence it spread throughout Europe, where it has been cultivated for hundreds of years as a staple crop for hay, pasture, and fertilizer. In America it was known as early as the colonial period; and it now grows from Canada to the Gulf of Mexico and from the Atlantic to the Pacific, flourishing in some parts of every State, in the wild state or as a weed, and in a few localities as a cultivated field crop.

This plant is a biennial, requiring two years to mature and bear seed. The first year it has no bloom, grows erect and attains a height of 3 to 4 feet, though a single plant growing by itself will have a tendency to branch out more. It bears a heavy growth of trifoliate or three-lobed leaves resembling alfalfa, and stays green through the fall until hard freezes of the early winter. The second year it comes up from the roots very early in the spring, stooling out at the root-crown with usually about 10 to 20, but often more than 50, stalks or stems from the same root. It now bears still heavier foliage of a rich green color, and attains a height of about 4 feet the latter part of June. At this period it throws out a number of long lateral branches, and the main stem shoots up to a height of 6 to 10 feet, and is from a quarter to a half inch thick at the ground. The early part of July the plant reaches full bloom, has lost many of its leaves, and assumes the branch-like appearance that causes it often to be called "tree clover." The seed ripen about the first of August, are in close-fitting pods, and are borne on slender racemes 3 to 4 inches long. Before branching out preparatory to seeding, a field of sweet clover resembles alfalfa so closely that it is often mistaken for alfalfa by those not intimately acquainted with the plant.

The early development of the root system is merely a taproot that reaches well into the subsoil the first two or three months after germination, in search of food and moisture. Toward the end of the first season the roots acquire an enormous growth and become thick and "fleshy;" sometimes maintaining the original form of a single taproot, but more frequently branching a few inches below the root-crown into several large thick roots, and these supporting a network of finer roots reaching in every direction. The second year the roots grow thicker and heavier, and, after supporting the season's growth, die and become a part of the soil. Sweet clover develops the largest root-growth of any of the legumes, and is vigorous and prolific in bearing numerous nitrogen nodules.

There is but one species of the white sweet clover, though there are different strains. The tame or cultivated sweet clover has a more luxuriant growth, is eaten more readily by stock, and is otherwise superior to the wild sweet clover that is commonly seen growing as a roadside weed.

BIENNIAL YELLOW SWEET CLOVER.

What has already been said applies equally well to the biennial yellow sweet clover, with the exceptions noted herein. The biennial yellow is not so generally distributed as the white, as it is grown in only a few States to any extent. Unlike the white, there are many species of the yellow sweet clover, about 20 having been noted in the United States, ranging from low, bunchy, and dwarfish plants, and crawling or vine-like varieties, to the tall, erect, and more vigorous kinds that are cultivated as field crops. The farmer will not be interested in any of these but the tall, cultivated variety, except to avoid the others in securing his seed. The yellow sweet clover blooms and ripens its seed about a month earlier than the white. It does not grow so tall or rank as the white, the stems seldom being more than a quarter of an inch thick at the ground, and for this reason is preferred by some who want it for hay only.

SEED AND METHODS OF SOWING.

SEED.—There are many kinds of sweet-clover seed, as there are numerous kinds of cultivated and wild alfalfa seed. White sweet clover grows in every State in the Union, the seed is harvested for the market in only a few localities, principally in some of the Southern States, in the far West, in a few counties in Northern Kentucky, and in a small way in some of the States of the Middle West. Only the white-sweet-clover seed is gathered in the Southern States, and the far West furnishes the seed of the small annual yellow or Indian sweet clover. Northern Kentucky produces the greater part of the biennial yellow, and the best grade of the white-sweet-clover seed, it being the most northern-grown seed that is harvested and has more vitality, is larger, and germinates better than seed grown in the extreme south.

Owing to its tendency to shatter from the stems, the seed is harvested by cutting the clover when the dew is on or after a shower, and when dry is beaten out with sticks over a canvas and stored in an airy, sheltered place to dry thoroughly. In most cases it is then partially cleaned of stems and leaves with a sieve; but there is no uniform method of cleaning; and there being no standard of quality or grading, it is generally put upon the market in a haphazard and indifferent manner, with little care exercised in preserving the vitality or purity of the seed. The seed has a coating or hull, as is the case with timothy and blue-grass seed, and weighs, according to condition and extent of cleaning, from 20 to 35 pounds to the measured bushel. In harvesting there will be ripe seed and bloom on the same stalk, and seed in all stages of development; hence it is important that

the seed be well cleaned and the small, light, and immature seed graded out, otherwise the percentage of germination will be low. The yield of seed varies from 10 to 25 measured bushels per acre.

Not until within the last few years has there been any native-grown sweet-clover seed on the market in this country, all the seed having been imported, and selling at from 30 to 45 cents per pound. Much of the seed now upon the market is either from the wild strains or from the small annual yellow or Indian sweet clover, which is saved as a by-product in thrashing grain, and is foisted upon the market as "yellow sweet clover" or as just "sweet clover." The seed of the white and biennial yellow being very much alike in appearance, only experts are able to distinguish one from the other, and one is sometimes sold by seed merchants under the name of the other. The seed of the annual yellow or Indian sweet clover found upon the market is always hulled seed.

The first important step in sowing is the selection of good seed, which is, of course, essential to the maximum of success. This involves purity, trueness to name, vitality and vigor, and adaptation to the climate and conditions where sown. Many of the failures in sowing alfalfa and clovers might be accounted for by the use of seed from the humid sections for sowing in the arid regions, or seed grown by irrigation and sown where irrigation is not practiced, and by great differences of climate and temperature. If the yellow sweet clover is wanted, secure the cultivated biennial kind, and avoid the small annual or Indian sweet clover, which is not suited to general farming. If the white is preferred, the northern-grown seed should be selected, as it germinates better and is more vigorous; and the cultivated strains will yield more than the wild.

Methods of Sowing.—It should be borne in mind that sweet-clover seed has a very hard seed coat or shell over the germ, which requires plenty of moisture and considerable time to soften so as to permit germination. This peculiarity exists more or less with all this class of field seeds, but is more pronounced with sweet clover, and is attributed by some who are unfamiliar with it to a lack of vitality in the seed; but such is not the case, as tests made under the sulphuric-acid treatment or with scratched seed promptly show that between 95 and 98 per cent of all seed in this locality is vital and germinates well, and many tests show 100 per cent vitality. In rare instances, if sown late in the spring, and followed by dry weather, the seed will lie dormant in the ground until the next spring and then come up and make a good stand.

There are two principal methods of sowing: First, sowing broadcast on top of the ground without covering; and, second, sowing or drilling with cultivation or preparation of the soil and covering of the seed. The two methods will be considered separately.

Sowing by the first method can be done from late in the fall to early spring, the earlier the better, thus giving ample time to saturate and soften the hard seed coating over the germ and pave the way for a complete germination with the advent of warm weather. This method of seeding has the advantage of convenience, as it can be done almost any time within a period of several months, and of economy, as there is no expense or labor of plowing, harrowing, etc., and permits the use and occupation of lands for sweet clover that either could not be plowed, or that would not be profitable to seed if they had to be plowed and cultivated. This method is also used in sowing sweet clover with wheat, rye, winter oats, and sowing with other grasses in meadows and pastures.

The months of December, January, February, and March are the best for sowing broadcast without covering, and this is when most of the sowing is done in Northern Kentucky, where sweet clover has made a greater success than in any other part of the country. November is too early, as the seed may germinate before winter and the young plants be killed by hard freezes immediately following; and March is late enough in the spring to allow the seed to become covered by rains and alternate freezes and thaws.

By the second method, the first sowing will likely be with spring oats or barley, when sweet clover may be sown and covered lightly with them, or sown afterward and covered with a drag or harrow. But a much better time is in April and May (according to the season), with a seed bed made fine by tillage, the seed sown and covered lightly and the ground firmed with a drag or preferably a roller. This is the ideal time and manner of sowing alfalfa, and applies equally to sweet clover. Some prefer late summer or fall sowing, from July to September, which has this advantage, that a full crop of clover can be cut the next year, thus gaining practically one whole season in maturing the plant; it also allows opportunity for frequent tillage of the soil during the summer to destroy weeds. But it must be sown in time to get a start before the hard freezes of winter set in. Another method is to sow with corn at the last cultivation, which is highly recommended by practical agriculturists and is much practiced in some parts of the country.

Nurse Crop.—While the supposed object of a "nurse crop" is to shelter and protect the young plants while tender, as practiced in most instances, it is used for the purpose of getting a crop of grain while waiting for the young clover to come on. It is reasonably certain that they are of no advantage, as they rob the young plants of moisture, light and food, which sometimes proves fatal. The better practice with sweet clover is to sow alone, but if a nurse crop is used, rye and spring barley are the best to sow with, as they shade the ground the least; wheat, and especially oats, shade the ground the most. Some sow about a quart of rye to the acre, with clovers and alfalfa as a nurse crop, which comes up and affords some shelter for the young plants from the cold winds in the spring and from the hot rays of the sun in summer; but these advantages are more theoretical than certain.

Amount of Seed.—The amount of seed required per acre depends upon whether sown for hay, pasture, green manure, or for restoring worn or waste lands. On account of its stooling out so heavily, a medium stand the first year will become a thick stand the second, when it comes from the roots; and a heavy stand the first year will be entirely too thick the second year to obtain a normal growth and development of the plant. For hay a bushel will sow three acres; for green manure a bushel will sow two acres, if to be plowed under the first year, and three acres if to be plowed under after the second year's growth. In sowing for pasture the amount of seed depends upon the amount of other seed forming the mixture to be sown, or the stand of grass already growing. All good pastures ought to have not less than two kinds of clover and three or four kinds of grasses, and the more the better. One bushel of sweet-clover seed to six acres of pasture containing a fair stand of other grasses is recommended; and the same amount for mixing with timothy, alfalfa, and red-top meadows. One bushel of seed to six acres is also recommended for sowing on waste and idle lands for restoring them to fertility and stopping and filling washes and gullies. A well-developed plant will bear from one thou-

sand to two thousand seeds, and it does not take long to spread over a field after once seeding; but while it seeds rapidly, it is advisable and economical to sow enough seed at the start to secure a good stand.

Being a biennial, it is a good plan to sow sweet clover in a field both the first and second years, thereby having a continuous pasture and hay crops. It will bring an agreeable surprise if some seed is scattered about in waste places, in washes, and on rocky or poor points, where it will grow and rapidly bring about a remarkable change in the condition and fertility of the soil.

While endeavoring to arrive at a fair estimate of the value and merits of sweet clover on the farm, one is likely to encounter differences of opinion; for some may have expected too much from it and are disappointed; a few have tried once and failed to get it to grow, and others having had more or less success become over-enthusiastic in praise of its merits. The truth is, no one plant fulfills all the requirements of an ideal forage crop. The greatest one is perhaps alfalfa, but it is a rather particular chooser of soils and climate, requires special tillage and inoculation, and then is uncertain. It will not stand pasturing, and has many insect enemies.

Hogs pastured in a field of white sweet clover near Delmar, Iowa.

Strangely enough, in the onward march of our great agriculture there has been little attention given to alfalfa's first cousin, sweet clover, and consequently there is really but little known about it among farmers generally. That it is rich in food value, grows luxuriantly, stands grazing without injury, and thrives in a great variety of soils and climates, that it inoculates readily and has no insect enemies, are enough to make it all but the greatest of leguminous forage crops, certainly next to alfalfa; and in some localities and soils where alfalfa will not succeed, there sweet clover will certainly have no superior. As it becomes better known it will come to have a prominent place in our agriculture, in feeding, rotation, and soil renovation; and as stock raising and dairying increase its place will become more and more prominent.

Some of us little realize the importance of our forage plants and think that only the plow and the hoe are producers of values. The truth is that our forage plants are of more value than all the cereals—corn, wheat, rye, oats, rice, etc.—and the profits from beef, pork, mutton, the dairy and from poultry all come from the pasture rather than from the corn-crib or the granary. If our forage plants dried up or failed for but one season, there would be left us scarcely a single domestic animal.

Truly, the gift of the green herbage spreading out under our feet in its beauty and freshness, to adorn the earth and provide sustenance for man and beast, is the greatest and best boon of Providence. This was the foundation of the first primitive agriculture, and is now the dependence, the hope, and the profit of our best farming.

Falmouth, Ky., January, 1912.

COVERDALE ON SWEET CLOVER.

The writer of the following is, perhaps, the best authority on sweet-clover growing of any man in the United States if not in the world. His extensive experience in growing sweet clover himself, and also his opportunity of picking up information on the subject, owing to his position as lecturer before farmers' institutes, and as contributor to various agricultural papers, has made him the authority that he is. As he gives much additional information we place a series of articles he wrote for *Gleanings in Bee Culture* here in permanent form.

HOW TO GET A STAND OF SWEET CLOVER.

If one wishes to grow sweet clover for the seed alone he will find that it is not profitable, for this plant must be grown for all there is in it. Sweet clover differs from all other clovers, and requires entirely different handling. A good stand for seed

can not be secured on poor land in this locality; and even if it could, one would miss every other year, as this plant is a sure biennial. Furthermore, supposing it were possible to get a good stand, and the field were run for seed only for ten years, there would be only half a stand each year, as the old crop, if it were sufficiently thick, would smother the young plants and make the field very spotted. With fairly rich land there should be little if any trouble in getting a stand; but to grow sweet clover profitably, the field must be grazed during the early part of the season, until July 1st at least. After the stock is taken off, the clover will grow very rapidly, so that a fine crop of seed may be harvested. When the seed is sufficiently ripe, the field should be mown 12 to 14 inches from the ground, so there will be a heavy fall feed for stock after cutting. This is not true of either the red or alsike clovers. Stock thrive on sweet clover better than on any other legume that

If one does not care to keep cattle of his own, stock belonging to some one else might be taken in. If no seed is wanted, the cattle can be allowed to run over it the whole season; and if bees are kept, a honey harvest will begin July 5th and continue until frost. The bees work on the field like one great swarm from early morning until late at night, and every one who gets a taste of the sweet-clover honey legume wants more of it.

The white sweet clover should be cut for seed while the stalk is still green; and after the crop is run through the huller the hay will be superior to the best timothy. It is best to work with the crop when it is a little damp, to avoid shelling; and when hauling, spread a canvas over the rack, and occasionally empty this canvas over the middle of the stack.

I am beginning to see that white sweet clover will thrive well anywhere after the bacteria become fixed in the soil, and it will bring up old wornout

Sweet-clover hay cut with a mowing-machine, and raked into cocks for curing.

I have tried, and I have now had six years' experience.

The worst drawback is the difficulty in getting a good stand, as it takes two or three years before a field reaches its best, and during this time it seems like pulling teeth to plow it under, because it is worth too much to plow. However, in managing a field as outlined above, a crop of seed averaging two bushels to the acre can be secured each year, which, with the very excellent pasturage one gets, pays to an extent fully equal to a crop of corn, and there is much less labor.

At the Iowa Experiment Station, last year, five acres were sown to sweet clover in May, and a good stand was secured. The field was mown five inches above the ground, and it yielded 1½ tons of hay per acre. After this, sheep were pastured on it until winter set in.

This clover should be sown with timothy without a nurse crop. Cattle should be pastured on the field all summer, but not too heavily. The white sweet clover is apt to come up well, and then later get yellow or sick-looking in places. Perhaps one patch ten feet wide will do well, while another a short distance away gets sick, making the field look spotted.

land very quickly when once a stand is secured, as it produces a great amount of humus, and gathers an immense amount of nitrogen into the soil. In 1907 my sweet clover produced three bushels of seed per acre where the cattle were taken off in the middle of July. There would have been a better yield, perhaps, if they had been taken off earlier; but by so doing the young plants are sacrificed that are to grow the seed for the next season.

SOWING SWEET CLOVER WITH OTHER PLANTS.

White sweet clover can be sown any time from early spring until August 1, but no later in this locality. I prefer sowing it the first week in May, in good rich ground only.

Judge Quarton, of Algona, Iowa, sows white sweet clover with champion oats—about 20 lbs. of the hulled seed to 1½ bushels of the oats per acre. He cuts his oats high, then gets a fine crop of hay in October, and the second year pastures the ground.

A thin crop of barley will make good if sown on rich ground, if the drouth is not too severe. But I have never found a catch of sweet clover when sown on poor worn soil. The soil must be well supplied

with humus or lime, or both. Any pasture where either cattle or hogs have been grazing for two or three years will, when plowed and put in fine shape, give excellent results. In other words, the sweet clover will be a sure catch. Twenty pounds of seed per acre will pay every time.

Timothy also goes well with sweet clover. It is true that one can sow white sweet clover on almost any fairly good soil and get a catch in spots, but this is not very satisfactory. The same field, if seeded to other legumes and timothy, then in a year or two plowed up and seeded to sweet clover, will give very satisfactory results. The humus will answer every purpose, and the lime also sweetens up the soil so that it will grow. Sweet clover will not do well in the Middle States until the people learn what kind of ground to sow it on.

SWEET CLOVER FOR HOG PASTURE.

Nine years ago I sowed a sixty-acre field to white sweet clover, and also a forty-acre field. Although the plants started, not a single one lived until winter, and the whole undertaking was a failure because of the poor and impoverished condition of the soil. Many others around here lost their seed in the same way. The tables have turned, however, for we are now securing perfect stands of this legume, as shown by the picture of one of my neighbor's fields. His hogs enjoy a continued feast, and they keep it down to about six inches high by continual browsing. My neighbor has a field of alfalfa adjoining this, and he has been changing the hogs from one to the other, but he is much better pleased with the results from the sweet clover, as it is so much more hardy. He has now bought seed to change his alfalfa-field into sweet clover, as the alfalfa won't stand being pastured. A few more farmers in this neighborhood have secured seed, and will have hog-pastures just like this one.

The field sown is identical with our own, especially our hog-pasture. I have come to the conclusion that every farmer can and should have a hog-pasture like it. Every one around here who has come to my knowledge is very enthusiastic over the success, and is securing new supplies of seed to be sown next spring. This fact speaks louder than any other. My seed is all sold.

SWEET CLOVER AS A HAY CROP.

When I first began to grow sweet clover I had little thought of ever using it for a hay crop; but as time passed I began to see that it would answer very well as a dry feed. We experimented with one patch, and, contrary to what I had expected, a fine hay crop of superior quality was secured. This first field that we tried had been sown about the first week in May, and had been pastured to hogs until August, when all hogs were taken off. By October 10 the sweet clover stood 22 inches high, and then the mower was started. Just as soon as the hay was well wilted (but not dry enough to put in barns) it was raked into winrows and shaped into well-formed small cocks. These cocks, by the way, were just large enough so that they could be thrown on the rack in one good fork-load all at one time. This avoided scattering the leaves, which are as valuable as so much wheat bran. From this the reader will see the importance of putting up the hay so that it is not too dry when handled. All the handling, in fact, should be done while it is green and tough, when it can be gotten into the cocks before any leaves will be scattered around. It should stand in cocks until it is sufficiently cured to keep in the mow. We have always found that this clover has kept well when managed in this way.

Sweet clover harvested for seed by a self-binder.

White sweet clover is the worst of any of the clovers that I know of, to scatter its leaves when overdry; and the leaves being thick and meaty are surpassed by those of no other legume. A dairyman is lucky who has a good winter supply of first-year sweet-clover hay for his cows.

The cocks referred to will stand many rains and still be very good feed. Sweet clover sheds water better than common clover, and it has a smooth stem. The common red clover, because of its hairy stem, holds moisture, and quickly turns black and becomes unfit for feed. I have been happily sur-

prised to find that this first-year hay cures the nicest of any that I have ever made.

This coming fall we shall have fully forty acres of this kind of hay to make, and we intend to use a side-delivery mower; and, when it is sufficiently dry, to use a hay-loader. We think we shall not have much loss when we follow this plan; and when there are large fields this latter plan is much faster than any other. There should be two wagons, one loading and the other unloading at the barn.

I know of no other clover that can be depended upon to make a good hay crop the same year as sown. It has often been tall enough to mow in July; but at this time it would be very dangerous to mow it unless care were taken; for as yet there are no crown sprouts started; and if one mows the clover close to the ground in July, much of it will be killed outright. On this account, if one wishes to mow the first clover in July, or before the crown sprouts start, the machine must be set so as to cut high enough to leave stubbles that have a few leaves to make a start for the next crop. When the crown sprouts are started, the mower may be run close to the ground with perfect safety. These crown sprouts on the first-year crop will be seen close to the roots after removing about an inch of dirt. This is the reason, by the way, why this clover will not winter-kill. The crown sprouts are about an inch below the surface of the ground, so that a covering during the winter is a certainty—a point of vast importance to one who is depending upon this clover the coming season.

MAKING HAY FROM THE SECOND-YEAR GROWTH.

Handling the second-year growth is, perhaps, a more difficult problem, as the clover gets very rank early in the season before good curing weather arrives. In this respect it is just like alfalfa. We have never dared to try and cure the hay until along in June; but at the same time every effort that we have made has been successful; we have never yet made a forkful of poor sweet-clover hay. With the improved variety of white sweet clover that we now grow, I am not sure but that we might cure the hay even as early as the 1st of June. If we could do this, the problem of making hay from second-year's white clover would be solved, and two good cuttings could be easily made during the second year, and a seed crop secured late in the fall.

There are many ways in which this clover can be handled for hay. One plan, which is very successful and easily carried out, is to wait until the clover is in bloom, and just beginning to form seed. This is just before the leaves begin to show yellow. While the foliage is still on, go over the field with a self-binder and set in shock rows, two and two. These bundles will cure nice and green, and will dry very quickly. They should be hauled and stacked like oats until winter, when the bands may be cut and the bundles thrown in the mangers for any kind of stock. It will keep perfectly dry if well stacked, and will make very satisfactory feed. The binder should be run high enough to leave behind a stubble which contains a few leaves, otherwise it will die out. If the leaves are left on, a nice crop of seed of excellent quality can be cut later in the fall.

Another plan is to pasture the second-year clover with some kind of live stock until late in May or the first of June. The hay will then be just about right in good hay weather, and can be made just as though it were a first-year crop. The stubble should be left high, as shown in the illustration. It will be seen that some of the clover in the picture has not been cut well. In explanation, I will say that, just before we started to cut this hay, a new pitman arm had been put on the mower, and it drew the sickle too far one way, and hardly cut at all on the return stroke. If this had not been the case, there would have been a smooth top.

The cocks of hay shown were out in two showers, but nothing was colored except the outside. The middle cured to perfection, and went to the barn as green as tea leaves. This field was mown when just coming into bloom, and the stubble grew up and made a seed crop.

The reader may be interested to know that clover of any kind in this part of Iowa was very rare last year, as severe drouth had killed all other clovers except a little alsike here and there. Sweet clover grew as though there had been no drouth.

HARVESTING SWEET CLOVER FOR SEED.

The accompanying illustration shows a field of white sweet clover shocked and dry. We stacked this later, and did not hull it until it had gone through "the sweat;" then it hulled out very nice and clean. If hulled when tough and damp much seed would be left in the straw, and a good deal would also be left unhulled.

The harvesting of sweet-clover seed is very easy, as the self-binder ties it up perfectly and without strain. A big field can be tied and shocked in one day; and when in shock it is safe from all elements that might scatter the seed. If the field is harvested when still somewhat green the straw makes considerable roughage for the cattle and horses; but the seed crop will be lighter and of poorer quality. For this reason we now believe that it is best to let the field stand until well ripened—in fact, just as ripe as possible without having it shell out. If a field stands well filled with ripe seed, a thunderstorm with a high wind ahead of it may blow much seed to the ground; so it is easy to see that the operator should be on the lookout and get the binder in before such a thing happens. The time to bind it is when the field looks well loaded with black seed with but little green seed showing.

If a field has been cut twice for hay, and then is to be cut for seed, a mower with a buncher will be the best to use. If it can be gathered next morning, while dew is on it, into small cocks that can be handled at one forkful, it will be in shape to haul in to the stack or huller at any time. When dry a canvas should be spread over the rack to catch the scattering seed, and this canvas can be emptied into the stack or huller once in a while. Much fine seed will thus be saved, and the canvas will pay for itself very soon. No one should attempt to haul the seed without a canvas over the rack.

The straw turns water splendidly; and if at all well stacked it will be found nice and dry for winter use for bedding or for live stock to pick over. We formerly cut our seed so green that the straw made fair hay, but have since found out that it pays far better to let the seed ripen more, for the yield will be easily doubled by so doing.

One acre of the field shown in the picture was measured off and hulled alone, and produced 11½ bushels. This, by many bushels, broke all records that I have ever known of as a yield of clover seed, and it was in a season when no one else had any clover on his farm, either for hay or seed. This fact makes the sweet-clover business look good to me.

I have used a Birdsell huller, and it does first-class work with this clover. I have also used a common thrashing-machine, and prefer it to any other outfit, as it gets it out very rapidly, and does the work well. An extra set of concave teeth is put in for this purpose, and these are often used for hulling clover. Our machine men arranged the choppers so as to carry off nearly all the finer choppings behind the machine. This made the work go much faster. It is not difficult to run out 150 to 200 bushels of this seed in one day, and this can easily be hulled for 50 cts. per bushel, and even less if sufficient is grown to keep a machine in the field for a one or two weeks' run.

The thrashing-machine has no recleaner attachment, so the seed has to be recleaned from the machine. We count on having our machinist attach a recleaner, then all will be in first-class shape when done.

We cut our stubble ten inches from the ground, and the stalks sprout and bloom all the fall, and ripen more seed, which falls to the ground to reseed if one wishes to let the field grow up to sweet clover the coming year. We have such fields, and will just let them reseed themselves for hog pastures next summer. The bees are very busy on these fall stubbles until frost. In a few days the stubble shown in the picture was nearly white with bloom, and indeed it was a pleasant sight to see one great row of bees flying to and from this field all the fall.

Delmar, Iowa. FRANK COVERDALE.

Sweet clover is quite an important honey-plant in Utah. One of our subscribers, Mr. J. C. Swaner, has had considerable experience with this plant. In *Gleanings in Bee Culture* for Jan. 1, Vol. XVII., he writes:

Sweet clover grows here along the water-courses, moist waste places, the roadsides, and in neglected fields. It grows from six inches to as many feet in height, according to the location, and is covered with an abundance of bloom from top to bottom, yielding in most seasons an abundance of nectar, which, after being gathered and stored, produces honey of the very best quality and color. It does not generally bloom the first year; but in the second it commences about the first of July, and keeps up a continual bloom until killed by frost, furnishing bees with pasturage, generally from the middle of July until the latter part of August.

Sweet clover is sometimes used for pasturage, and also for making hay, if cut when young, but it is a long way behind alfalfa for that purpose. Though it is sometimes relished by stock, very few would sow it for feeding. When eaten while green it is in a measure a cause of hoven, or bloat, in cows. If you wish good milk or butter you had better not feed it to milch cows, as it imparts a very disagreeable taste. Eaten off by stock it soon recovers, producing an abundance of bloom for the bees.

As sweet clover is a biennial, it is not a very hard weed to eradicate, and seldom troubles cultivated fields, though it does sometimes seed a field; and if such field is planted to grain the following season, it will come up, and is cut off only with the reaper. Next season, if the same field be neglected, it will quite likely be covered with sweet clover, and that, too, sometimes as high as your head. But where a field is cultivated as it should be for two seasons, the clover entirely disappears. The plant requires a little moisture in the soil the first year; but after that it will grow without. I consider it, for my part, a great deal better to see a roadside lined with it than with sunflowers, etc.

Now, to sum up, sweet clover yields our main honey crop in this locality. It is our best honey; and I may say without boasting, it compares favorably with the finest grades known.

Salt Lake City, Utah. J. C. SWANER.

SWEET CLOVER ON ALKALI LAND IN THE WEST.

It is remarkable that sweet clover can be made to grow where nothing else will take root. We have seen it on the alkali lands of Colorado and California—lands where nothing could exist, except, perhaps, a kind of alkali weed that is absolutely useless to either man or beast; and yet we hear how sweet clover is regarded as a noxious weed by State legislatures and township trustees. Even in Ohio, mayors are ordered to cut down along municipal roadsides all weeds, including sweet clover, and yet there is nothing so good as a soil-binder for loose lands as sweet clover. We should not be surprised if it were worth millions of dollars to railroad companies to prevent the washing away of embankments, for that is where it does best, on hard yellow clay or other soil where nothing else can grow and take root.

There are big dumps near Cleveland where refuse, cinders, and slag of every sort are thrown; but we have noticed how sweet clover seems to find its way along the edges of these dumps, and it seems to be creeping all over, making the waste land productive of at least some good.

SWEET CLOVER FOR INOCULATING THE SOIL.

It has been clearly demonstrated by experiments conducted in several States that sweet clover is excellent for preparing soil which requires inoculating with bacteria before it will grow satisfactorily some of the well-known clovers, notably alfalfa, which frequently refuses to grow unless this is done.

The following letter by a practical farmer in the *Rural New-Yorker* explains how this is accomplished:

INOCULATION FOR ALFALFA.

At present I have about 15 acres of alfalfa, all of it seeded the first time, part inoculated when seeded. I have used soil from an old alfalfa-field, and that where sweet clover grows along the roadside, as it does everywhere in this locality when permitted, and I have thought I obtained the best results from the use of sweet-clover soil. I have seen sweet clover five or six feet in height growing along the road on the hardest kind of subsoil two or three feet below the surface soil. I believe the bacteria on such sweet clover to be more vigorous as a nitrogen-gatherer than that obtained from alfalfa as it is usually grown. The proper time to apply the soil to the intended alfalfa-field is after the ground is plowed and leveled, before the seed is sown. I understand a bright sunshine will kill the bacteria. It should be sown on a cloudy day, and immediately cultivated in the ground. I have always sown the soil broadcast by hand, using a pail to carry dirt in. If I had to purchase the soil, I think 100 pounds might do. Use more if it can be readily obtained. If taken from an alfalfa-field I should want to know that the bacteria were well developed. The bacteria will not be present to any extent in alfalfa that is manured heavily enough to supply the nitrogen requirements of the plant. In one field of alfalfa I inoculated a strip about two rods wide in the middle to find out the benefits of

inoculation. The narrow strip has been a great contrast to the adjoining ground, and I am convinced that the yield was twice as great, of a better grade of hay than that which was not inoculated. There was a perfect stand on that inoculated. It was inoculated with sweet-clover soil. The field has been sown three years, and last year the yield was four tons per acre; and I believe that, if it had all been inoculated when seeded, it would have been at least six tons. There was not quite the difference this last year between that which was inoculated and that which was not, which proves it will inoculate itself in time. I have a 96-acre farm, 70 acres under plow, and sell on an average 150 hogs per year besides lots of other stuff.

Fremont, Ind.

Land which, for some reason not easily explained, has become "clover-sick," can be redeemed by the use of sweet clover by the same method. There may be exceptions to this, but, as a general statement, it is true, for there have been too many experiments to admit of doubt.

H. R. Boardman, in *Gleanings,* Vol. XXII., writes of it as follows:

AS A FORAGE-PLANT.

I once supposed, as most people do now, that sweet clover was entirely worthless as a forage-plant for stock—that nothing would eat it; but I have demonstrated to my entire satisfaction that horses, cattle, and sheep, will not only learn to eat it, but will thrive upon it, both in pasture and dried as hay, and that hogs are fond of it in the green state. I say, they *learn* to eat it, because most stock have to acquire a taste for it, not taking readily to it at first. I gave it a fair trial for pasture last summer. My horses and family cow fed upon it almost entirely during the dry part of the season. They became fat and sleek, without the help of grain or other feed. The milk and butter from the cow showed no objectionable flavor. The amount of feed furnished was something surprising. It has a habit of continually throwing out or renewing its foliage and its bloom; also, when cut or fed back, it keeps constantly fresh.

East Townsend, O. H. R. BOARDMAN.

It is now well established that cattle will generally eat sweet clover green, although some consider it objectionable as pasturage. Prof. Tracy, of the Mississippi Agricultural College, and Prof. Charles E. Thorne, of the Ohio Agricultural Experiment Station, Wooster, speak highly of it as a hay plant, but say, as do others, that stock must *learn* to eat it. Livingston's catalogue calls it "quite valuable for soiling." Its general character as a good honey-plant is well established, and it may be well worth while to give it a thorough test. On some alkali lands of the West it is the only plant that will live and thrive.

The following, by Alva Agee, editor of the *National Stockman and Farmer,* is striking testimony to the value of sweet clover as a soil renovator. No two men are held in higher esteem by scientific farmers in this country than Alva Agee and F. E. Dawley, both very successful farmers on their own account.

TEST SWEET CLOVER.

How many of our readers are going to test sweet clover as a soil-improver for thin land? This is a legume, making free use of the air's nitrogen and growing rank on land that is poor. Its value as a soil-renovator certainly has not been appreciated. We should have more definite data on this subject. When the clover is cut early for hay, as is done in the case of alfalfa, the hay is nutritious, and Hon. F. E. Dawley, of the New York institutes, who has grown it for many years as a cover crop in an orchard says that his cattle like the hay after it has been sweated in the mow. The ability of sweet clover to furnish a big amount of humus-making material to poor land is probably its most attractive point. There is prejudice against this plant because live stock does not graze it, as a rule, and it is a weed where not wanted, but I believe it will furnish more nitrogen and humus to a very poor soil than any other plant we have, provided the sweet-clover bacteria are present in the ground. In that respect it is like alfalfa and all other legumes.

Farmers' Bulletin No. 18, of the general government, in speaking of the value of sweet clover on poor soil, says: "As a restorative crop for yellow loam and white lime lands this plant has no superior, and for black prairie soils it has no equal."

Again, Farmers' Bulletin No. 485 on sweet clover from the Department of Agriculture is one of the most valuable treatises on the plant that was ever put out. Every reader of this work should send for it. Address the Secretary of Agriculture, Washington, D. C., enclosing 10 cents.

For further particulars see booklet entitled "Sweet Clover," by the publishers of this work. It contains the statements of a large number of farmers and beekeepers certifying to the value of the plant as a forage-plant both for bees and cattle. It will be furnished for the asking.

SYRIANS.—See HOLY-LAND BEES, under ITALIANS.

SYRUP.—See FEEDING.

T

TEMPERATURE.—Of hives and cellars, see WINTERING; also HIVES, sub-head "Double-walled Hives."

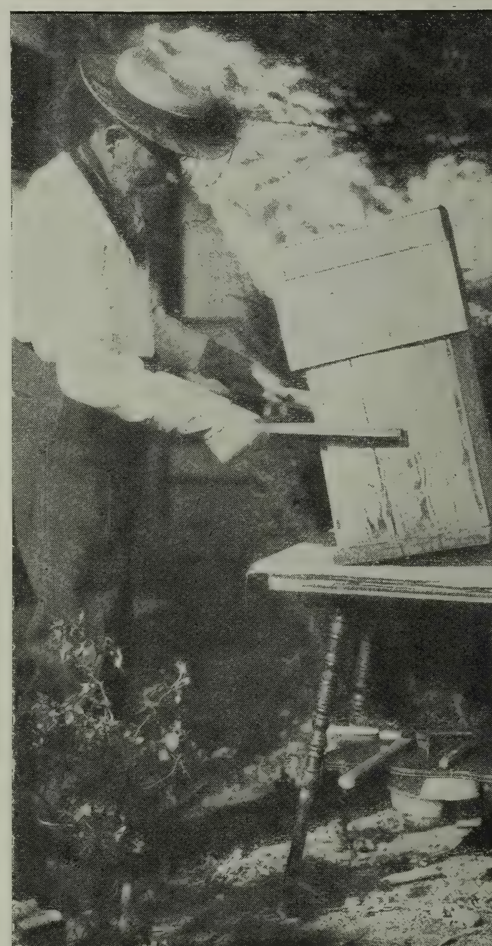
THISTLE.—See CANADA THISTLE.

TI-TI (*Cliftonia parvifolia*).—Called also ironweed, leatherwood, and red ti-ti. The ti-ti is a small shrub of the evergreen type, in swamps and along river courses and streams pretty generally over northern Florida. The bark is smooth; the stem much branched but very compact. The leaves are oblong, leathery, shining green on upper side, and paler below. Blossoms are small and white, appearing in February or March. Bad weather affects bloom and also yield very quickly, and it is not a sure producer of honey for that reason. Honey is red in color, and flavor rather strong, good mostly for bakers' use. It is not good for table honey, much less for comb honey. Extracted it is an item in the Appalachicola section, as preparatory for the tupelos that follow.

TRANSFERRING.—Make all arrangements several days before if possible, so the bees may grow accustomed to the surroundings, and be all at work; we should choose a time when as many bees as possible are in the fields and nicely out of the way. About 10 o'clock A. M. will probably be the best time, if it is a warm, still day. Get all your appliances in readiness, every thing you think you may need, and

Box hive turned upside down preparatory to drumming out the bees.

some other things too, perhaps. You will want a fine-toothed saw, a hammer, a chisel to cut nails in the old hive; tacks, string, such as the grocers use; a large board to lay the combs upon (the cover to a Dovetailed hive will do); a tablecloth or sheet folded up to lay under the combs to prevent bumping the heads of the unhatched brood too severely; a honey-knife or a couple of them (if you have none, get two long thin-bladed bread or butcher knives), and lastly a pail of water and a sponge to keep every thing washed up clean. A great part of this is really women's work; and unless you can persuade your wife or sister, or some good friend among the sex to help, you are not fit to be a beekeeper. A good smoker will be very handy; but if you have none, make a smoke with some bits of rotten wood in a pan; blow a little in at the entrance of the hive, tip the old hive over backward, and blow in a little more smoke to drive the bees down among the combs; let it stand there, and place the new hive so the entrance is exactly in place of the old one; put a large newspaper in front of the new hive with one edge under the entrance. The bees returning laden with pollen and honey now alight and go into the hive, only to rush out again in dismay at finding it empty; we therefore want to get one comb in for them, to let them know it is their old home. Move back the old hive a little further, in order to get all round it, and give the bees a little more smoke whenever they seem disposed to be "obstreperous." Some beekeepers pry off the hive-side and proceed to cut out the combs, with the bees running all over every thing. Of course, this necessarily kills many, to say nothing of the nuisance of having bees crawling over the ground, up your trousers-legs, etc. A better way is to place a small box over the inverted hive, large enough to receive the whole cluster of bees. Now drum on the hive-sides with a couple of sticks or the palms of the hands, until the bees run up into the box above. Nearly all of them can be induced to leave their combs for the box, which should be removed as soon as a majority of the bees have gone up into it, and placed to one side. You can now pry off a side of the box hive, having the bees practically out of the way. On a flat board lay each comb or sheet of brood, as rapidly as cut out, and over it the frame into which you are to transfer the comb. With a sharp, keen-edged knife mark out on the comb the size of the frame—that is, its inside dimensions. Remove the frame and cut along the mark, after which slip over the frame. If the comb will not stay se-



Drumming bees up into the empty box.*

curely without any fastening, wind string a couple of times around, and tie. We recommend string in preference to transferring-clasps, transferring-wires, and every thing of that sort, for the reason that the bees will not forget to remove the strings, bit by bit, by the time the comb is fastened. Rubber bands are said to be

* This is no sort of way to " drum " bees. Life is too short. Use the foot or anything which will give a *jar*. It is to make the combs tremble and that rather violently.—A. C. M.

applied more quickly than strings. Proceed thus until you have used up all the brood and *good* comb, as it does not pay, at present prices of foundation, to use small pieces. All such should be put into the solar wax-extractor. See WAX.

FIG. 1.—Removing one of the sides of the box hives.

Pieces of comb containing brood *can* be fitted into the frames; but somehow we would manage to secure all the brood possible inside of the frame in one large piece; whereas little scraps that may be left had better be consigned to the solar wax-extractor. After all good combs are transferred, any remaining space in the hive should receive frames of foundation to fill up.

It is next in order to dump the box of bees laid at one side, over the top of the transferred combs, and in front of the entrance, and the work is done, after all refuse has been removed. There should, of course, be no dripping pieces of honey lying around. Any chunks of good honey left after transferring are put into a pan, to be used up at the family table. All the rest should be consigned to the solar wax-extractor, as stated.

In transferring it makes no difference which side up the brood-combs are placed; turn them horizontally from their original position, or completely upside down, as is most convenient.

WHEN TO TRANSFER.

Several inquire if we would advise them to transfer bees in the months of June, July, August, etc. We really do not see how to answer such a question without knowing the persons. Among our neighbors are those who would work so carefully as to be almost sure to succeed; and, again, others who would be almost sure to fail. We are inclined to think those who make these inquiries would be quite apt to fail, for careful people would go to work without asking questions, and do it at *any* season if they were sufficiently desirous. Bees *can* be transferred any month in the year when bees can fly. When done in June or July, we need an extractor to throw out the honey from the heaviest combs, before fastening them into frames. Spring, or, more exactly, the time of fruit-bloom, is decidedly the best time, because there are then fewer bees and less honey, as a general thing, than at other times.

FIG. 2.—Box of bees placed in front of the entrance of the hive.

Bees fix up the combs better when honey enough is being gathered to induce wax secretion to some extent, and the period of fruit-blossoming seems to secure all these advantages more fully than other seasons.

TRANSFERRING UNDER A CAGE OR TENT WHEN THE BEES ARE DISPOSED TO ROB.

We recommend the time of fruit-bloom, because then the bees usually get honey enough to prevent robbing. Should it be necessary to do it a little later, say between fruit-bloom and clover, use the cage or tent described under ROBBING.

Bring the bee-tent and all other necessary tools for transferring, and stand them near the old box hive. Drum the bees into a box as previously described. With a cold-chisel cut the nails so that one side can be removed. After the side is taken off, arrange every thing as compactly as possible. This done, step inside the tent, grasp the intersection and "spread" yourself, as it were, over your work. You will now be secure from robbers.

The operator inside has the old hive from which he is transferring, together with the new hive and all necessary fixtures for holding the combs in the frames. Besides these he has a saw, chisel, thin-bladed knife, smoker, bee-brush, a large shallow drip-pan to catch drippings of honey, and clean wired frames.* To make his work as easy as possible, he sits on a tool-box. In case he wants a frame or tool which by oversight he does not happen to have, an assistant, who may be engaged elsewhere in the apiary, at a call brings in whatever he desires.

One may think that transferring in this tent is pretty close work, but we have transferred in this way a number of times easily and successfully, and the tent proved no real hindrance.

Mike Wall, Tempe, Ariz., and pile of odd-sized frames from which he had cut the comb and fitted them into Langstroth frames.

A SHORT WAY OF TRANSFERRING.

A little before swarming-time, pry the top from the box hive and set a single-story hive over it, making all the joints bee-tight. Now hang frames filled with foundation in this new hive, and the bees will soon work up into it. After the queen gets to laying in these combs the bees will soon all move up into it, when it can be lifted off and transferred or the

* We recommend wired frames, as the wires serve to hold the combs in place. Lay the frame on the comb, and, where the wires come, mark cuts with a knife, when the wires will sink into the comb. The wires serve to hold the comb in place, making it almost unnecessary to use fasteners to hold the comb in.

combs melted up. Where hurried, this plan gets the stock gradually into improved hives without very much trouble, and no mussing with dripping honey.

HEDDON SHORT WAY OF TRANSFERRING.

The prying-off the hive-side, incurring the risk of robbers, cutting brood, and all other incidental difficulties of older methods in transferring, suggested to the late James Heddon another way that will commend itself especially to beginners who dread stings and the "awful sticky" job. Foundation is now so cheap, and combs built from it so much superior to those built naturally, while the combs in box hives are almost universally crooked, we believe our readers will, on the whole, do better to follow the Heddon short method. Indeed, whenever we have occasion to transfer we use it exclusively.

Let us assume that the hives, having been received in the flat, are put together and painted, and contain frames of wired foundation ready for the bees. Light the smoker and use a bee-veil. Move the old hive back four or five feet, and put the new hive in its place. Prepare a small box about eight inches deep having the top open, that will just cover (not slip over) the bottom of the box hive. Turn the old hive upside down; place the hiving-box over it, and then drum on the sides of the hive with a couple of sticks until about two-thirds of the bees pass up into the box. Gently lift off the box containing the bees, and dump them in front of the entrance of the new hive. Make sure the queen is among them, by watching for her as she passes with the rest toward the entrance. If you do not discover her, look inside the hive. When you still fail to find her, drum more bees from the old hive again until you do get her, for, to make the plan a success, she must enter the *new* hive.

A frame bone-yard.

Replace the box hive right side up, two feet back of the new one, with its entrance turned at right angles. It still retains about one-third of the original colony, together with all the combs and brood. Allow the old hive to stand at least 21 days, by which time the brood will be hatched out, with the exception of a few drones of no value. Turn the hive upside down, and drum out the remaining bees into the hiving-box, as before. Next put an entrance-guard (see DRONES) over the entrance of the new hive,

Smoke the bees of the hive and also those in the hiving-box, after which dump it in front of the entrance of the new hive, as before. The smoking is to prevent any fighting on the part of the bees at the second shake, and the entrance-guard will catch the queen or queens that have been raised meantime in the old hive. These one or two, if virgins, should be caught on the perforated metal and given to queenless stocks. Where the old queen in the new hive is valuable she should be caged at the time of making the second drive. If neither the one in the old hive nor that in the new is preferred, perforated zinc need not be used, nor the old queen caged.

The work of transferring is now completed, and all you have on hand is a box hive having a lot of old crooked combs, containing perhaps a little honey and drone brood. The honey can be extracted, or used as chunk honey on the table, where fit for use, the combs melted into wax, and the hive itself becomes first-class kindling wood, because smeared on the inside with propolis and bits of wax.

The method above described is known as Heddon's short way. As it is neat, quick, cheap, and certainly more satisfactory in results, we recommend it in preference to the old way.

There is one difficulty with the Heddon method: When transferring by that plan shortly after the honey season the combs are apt to be filled with honey. How shall we get it out? When the bees have all been driven out for the last time, we may cut the combs in pieces and extract the honey from them. But a better way is to stand the box hive 100 yards or so from the apiary, on a board, and contract the entrance so that only one bee can get through at a time, as explained at the close of the subject of ROBBING, which see. A little furore of bees may start up at first; but it soon quiets down, and in a few days the bees will have quietly removed all the honey from the combs. No unpleasant disturbance follows in the apiary, because the bees have taken the honey slowly, about as they do from natural sources. When the hive is emptied of honey the bees stop visiting it, of course, and then you may cut out the combs, put them in a solar wax-extractor, and consign the old hive to the kindling pile.

It should be stated, however, that if there is foul brood in the vicinity bees should not be allowed to rob honey out of an old hive like this, because there is too great risk of spreading infection.

THE GUERNSEY METHOD OF TRANSFERRING.

This plan is recommended by E. D. Townsend, of Michigan. He thus describes it:

During the season of 1910 we transferred 30 colonies of bees by the Guernsey method. The plan is something as follows: At the approach of the main honey-flow (which is from clover here at Remus, where this work was done) a set of brood-combs from a hive in which the bees died the previous winter is set on top of the colony to be transferred. In a week the queen will have taken possession of these combs, and will be found laying above. At this time a queen-excluder is slipped in between the two hives. In 21 days, or as soon as the brood is hatched out of the combs in the old or undesirable hive, it is removed and the colony in the upper hive is given a bottom-board and the work is done. If foundation is used instead of drawn combs, a frame of unsealed brood should be placed in the center of the new hive to entice the queen above. The combs in the old hive may now be set out and the honey "robbed out," so that they can be rendered for wax. A beginner might wonder why it would not be better to use empty frames instead of foundation, as they would be cheaper; but these bees are not in condition to build good combs, hence combs with 4½ to 4 cells to the inch (drone size) would be built, which must not be tolerated. The colony would likely be worth more in the old hive than to be transferred by this plan without either drawn combs or full sheets of wired foundation; for the combs in the undesirable hive were likely built by the bees of a new swarm that were in condition to build a large per cent of worker combs.

In detail the plan is as follows: In Fig. 1, No. 1, a hive is shown with cover removed. This hive, as will be seen, was filled just as full of brood-frames as it would hold before the swarm was hived. There was, by actual counting, just three spaces short between the top-bars of the frames, where bees could pass up above. This was not as much opening as we desired, for we knew that the queen would never pass up through such small openings and take possession above. We inverted the hive as shown in No. 2, and found just what we wanted—*i. e.*, wide spacing. The party who made the brood-frames used more narrow material for his bottom-bars than for the top-bars, and consequently at the bottom there were plenty of open spaces for the bees and queen to pass above through. Box hives, or hives with immovable covers, are inverted and transferred in the same way.

The brood-nest of combs that we wanted to transfer these bees into was now set upon this inverted hive, and in a week we found that the queen had taken possession above. We tried three plans to get the queen above the excluder, in different colonies. During the middle of warm days the queen is most likely to be expanding the brood-nest, and is then more apt to go above. We found that, if we began looking for the queen while the new hive was still over the old one, the queen would get frightened and run down below; so now we quietly lift the upper off, as in No. 4, and set it on an empty body while we are looking for the queen. The second plan was to lift off the upper body quietly, as before; but instead of looking for the queen, we placed an

Method of transferring as carried out by E. D. Townsend.

excluder on the hive as in No. 5, then set the body back on as in No. 3, and cover up for about four days; then, if eggs are found above the excluder, the queen is in the right place; if not, the excluder will have to be removed and another trial made.

The third plan was to drive the bees from the lower hive by pounding on it, and when the major part of them were up in the new hive, we slipped the excluder in between; in the majority of cases the queen would be found above. This latter plan was worked upon some hybrids with which we had bad luck in getting the queen above. The hybrids were well adapted for this method, as their nervous disposition caused them to run about as soon as the pounding upon their hive began.

It will be noticed that these old hives that we transferred were about the size of the eight-frame L. hive, and that we transferred them into the ten-frame width of hive. Engravings 3 to 5 make this plain. The excluder projects over the edges about two inches. This space was left open during the three weeks or more it took to shift these bees into our regular hives. As it was during the honey-flow, and as they were all full swarms, there was no danger of robbing. Neither did this abundance of ventilation seem to do them any hurt, for it was summer time.

TRAVEL-STAIN.—See Comb Honey.

TULIP-TREE.—See Whitewood.

TUPELO OR GUM (*Nyssa*).—The tupelos are the most valuable honey-producing trees in Florida, not to say the entire United States. They are, at the same time, the most tantalizing. While the four native species are all clearly defined (though some authorities claim that they hybridize), the duplication and complication of common

names applied to the gums has given endless trouble to those trying to classify these trees through the local names only.

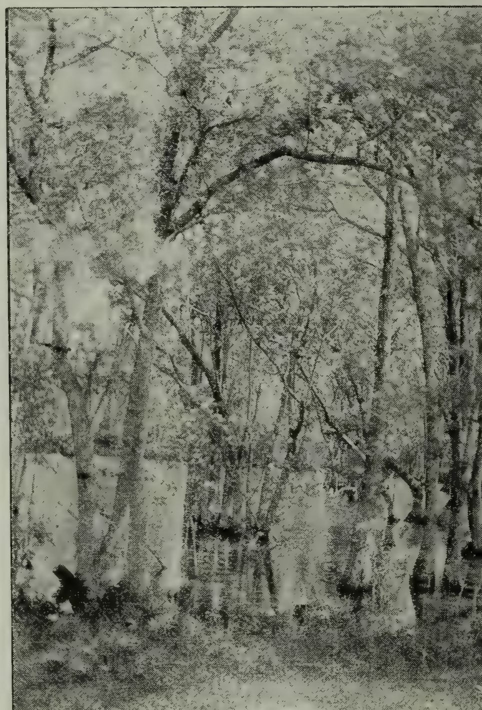
Aside from the identification of the tupelos by the characters of their respective woods, they are readily distinguished by their botanical characters. There are four native species, as follows:

1. The *Nyssa sylvatica* (termed *Nyssa multiflora* by some), which is variously named "black gum," "sour gum," and "pepperidge," is a highland species, a large forest tree growing, at its best, from 100 to 150 feet high, in rich upland woods of northern Florida and westward. The leaves are small and entire—that is, are not notched or lobed. The bark of this gum, as it grows older, finally breaks into hexagonal blocks. This is the giant of the tupelos.

2. The *Nyssa biflora.* This is called locally "water gum" or "water tupelo." It is very common in the estuarine swamps of the mouth of the Appalachicola and other northern rivers of Florida, but does not grow down to the river banks, perhaps because the water is too swift or too muddy for it there. It grows from 100 to 120 feet high, with a trunk diameter of from five to seven feet at base. Its favorite habitat is in swamps and on the margins of ponds, and can be recognized by its bark, which is from $\frac{3}{4}$ to $1\frac{1}{4}$ inches thick.

3. *Nyssa aquatica* (called also *Nyssa uniflora*). It is named, locally, "tupelo gum," "white tupelo," and "cotton gum." This is, as its name implies, also a low-ground species, reaching a maximum height of 90 or 100 feet in its best habitat; but in pine-barren ponds it is a small tree, a mere shrub, and is often taken for a different species by those not familiar with its habits. It is, when thus stunted, often called locally, "scrub tupelo." (The term "scrub" is not a definite nor accurate name.) It is occasionally found as far south as the middle of Florida, but is not of commercial importance except in the northern and western part of the State, and thence on into Georgia and further. It has large leaves, which are usually irregularly toothed, with a bark comparatively smooth, and thin, only about $\frac{1}{4}$ inch thick. The fruit, called drupes, is a dark purple. This tupelo, with the following, is the source of the "tupelo honey" of commerce, and this special variety is the greatest honey-producei of all the tupelos.

The country along the lowest part of the Appalachicola River is so thinly settled that the effects of civilization are hardly noticeable except for the removal of large quan-



Scrub tupelo of Georgia.

tities of cypress for timber by the lumbermen. Almost the only works of man that are visible from a boat, on this part of the river, are lumber-camps and apiaries, the latter to take advantage of the abundance of fine honey secreted by the *Nyssa aquatica* and

4. The *Nyssa Ogechee* (called also *Nyssa capitata*). The common names are "Ogechee lime," "black tupelo," and "Ogechee plum." It is only a small tree, but grows in deep swamps from central Florida to the north and west part of the State. It is of commercial importance, however, only in the northwest. The maximum height of this species is about 60 feet, usually much less, say thirty or forty feet, and the bark is irregularly fissured. The leaves are large, and the drupes red and very acid. The stems of the leaves are short. The blossoms grow under the leaves. The honey is white and the body thin, much resembling

that from cabbage palmetto. It comes into bloom in March, after the Titi, but just before the *Nyssa aquatica*.

Calhoun Co., which forms the western boundary of the Appalachicola River for

Sprig of scrub tupelo, showing the shape of the leaves and blossoms.

many miles at its southern part, is the banner honey county of Florida, producing annually about one-third of the honey crop of the entire State. The source of this honey is the *Nyssa aquatica* and the *Nyssa Ogechee* (commonly called "white tupelo" and "black tupelo"). These are the two great honey-yielding trees of the tupelos.

Note.—There is a fifth species of tupelo, called *Nyssa acuminata* by Small, which appears only in Georgia, a mere shrub, growing not more than seven or eight feet tall. It has smooth bark, branches and twigs red, and tops spreading. The honey closely resembles that from the *Nyssa aquatica* in body and color, being white and thick, but having a greenish cast to it. It is often called, locally but variously, "scrub tupelo," as are some forms of the *Nyssa aquatica*.

The best honey of all is, as indicated, that from the *Nyssa aquatica*. It is white and very thick, and of delicious flavor. When unmixed with other honeys it will not candy. It deserves to rank with the four best honeys of Florida, and with any of the best honeys of the world.

Black tupelo or gum with berries.

In the wonderful tupelo regions along the Appalachicola River in northwestern Florida, says E. R. Root, "there has actually been produced nearly 2000 barrels of honey, each containing from 300 to 500 pounds, in a strip of territory not over 100 miles in length, and perhaps a mile or a mile and a half in width on each side of the stream. One of the pioneer bee-

A part of one season's crop of 100 barrels of tupelo honey on the wharf, ready to load on the steamer, from the home apiary of Mr. A. B. Marchant, located in the wonderful tupelo regions of the Appalachicola River, Florida. See page opposite.

keepers in that region is Mr. A. B. Marchant, of Sumatra. During the year 1911 he actually harvested, from two yards of nearly 800 colonies of bees, 245 barrels. In 1904 he took 300 barrels from three apiaries, but from more bees."

"But what about this honey? What is it? It comes mainly from the tupelo, both white and black. If you go into southern Florida the local beekeepers will confidently tell you that 'the palmetto is the finest honey produced in the State.' In other regions they will say that 'mangrove carries off the palm;' but when you get into the northwestern country they will assuredly assert that 'a pure white tupelo without other honey excels them all.' It is of heavy body, and very mild in flavor. The claim is made that it rarely or never candies. Indeed, Mr. Marchant's son Ernest told me that they kept a barrel of it for ten years without its candying. Its mildness of flavor, and its non-candying quality, should make it an excellent honey for blending with honey of stronger flavor, like basswood, alfalfa, or clover."

U

UNITING BEES.—Uniting colonies is much like introducing queens, inasmuch as no fixed rule can be given for all cases. It is a very simple matter to lift the frames, bees and all, out of one hive and set them into another, where the two are situated side by side. Usually there will be no quarreling if this is done when the weather is too cold for the bees to fly, but this is not always the case. If one colony is placed close to one side of the hive, and the other to the other side, and there is room enough for a vacant comb or two between them, they will very rarely fight. After two or three days the bees will be found to have united peaceably, when the brood and stores may be placed compactly together, and division-boards put in at each side. If there are frames containing some honey that can not be put in, they should be placed in an upper story, and the bees allowed to carry it down. They should always be examined inside of twenty minutes or half an hour after they are put into one hive, to see if every thing is amicable on "both sides of the house." If any bees are found fighting, or doubled up on the bottom-board, give them such a smoking that they can not tell "which from t'other," and after 15 or 20 minutes, if they are fighting again, give them another "dose," and repeat until they are good to each other. We have never failed in getting them peaceable after two or three smokings.*

When it is desired to unite two colonies so large that a single story will not easily contain them, which, by the way, we feel sure is always poor policy, or if their honey is scattered through the whole ten combs in each hive, proceed as before, only set one hive over the other. When done during cool weather, and the bees kept in for two or three days, few, if any, will go back to the old stand. If the hives stand within six feet of each other, they all get back without trouble any way, for they hear the call of their comrades who have discovered the new order of things.

WHAT TO DO WITH THE QUEENS.

If one of the colonies to be united has been several days queenless, all the better; for a queenless colony will often give up its locality and accept a new one, if simply shaken in front of a hive containing a laying queen. From a hive containing neither queen nor brood, we have induced the whole lot to desert and go over to a neighboring colony, by simply shaking some of the bees in front of it. They were so overjoyed at finding a laying queen as to call

* Same thing applies exactly with bees and queen in direct introduction.—A. C. M.

all their comrades to the new home, then all hands set to work and carried every drop of honey to the hive containing the fertile queen. By taking advantage of this disposition we can often make short work of uniting. If we are in a hurry, or do not care for the queens, we can unite without paying any attention to them, and one will be killed; but, as even a hybrid queen is now worth 15 cts., we do not think it pays to kill them. We remove the poorest one and keep her safely caged until we are sure the other is well received by the bees. If she is killed, as is sometimes the case, we have the other to replace her. Where stocks are several rods apart, they are often moved a couple of feet a day while the bees are flying briskly, until they are side by side, and then united as we have directed. This is so much trouble that we much prefer waiting for cooler weather. If the bees are in box hives, the first work is to transfer them.

In conclusion, we would advise deferring the uniting until we have several cold rainy days, in October, for instance, on which bees will not fly. Then proceed as directed. If the reader has followed the advice we have given, we will have little uniting to do, except with queen-rearing nuclei; and with these we have only to take their hives away and set the frames in the hive below, when we are done with them. If the hive below is a strong one, as it should of course be, we set the frames from the nucleus into the upper story, until all the brood has hatched. If we wish to make a colony of the various nuclei, we collect them during a cold day, and put them all into one hive. If we have bees from three or four, they will unite better than if they came from only two hives, and we will seldom see a bee go back to its old home. A beginner should beware of having many weak colonies in the fall to unite. It is much safer to have them all strong and ready for winter, long before winter comes.

HOW TO PREVENT THE BEES FROM GOING BACK AFTER UNITING.

Reference has already been made to the fact that some bees will sometimes go back to their old stands after uniting. Under MOVING BEES we have discussed means for preventing this. The same principles that apply in that case will apply here with some slight modifications. In order that the reader may not be misled, it will, perhaps, be well to recapitulate to some extent and at the same time explain why and how the bees of several nuclei in the same apiary can be brought together in one stand so that very few if any will return.

After inclement or cool weather, during which the bees have been confined for several days, they may be united with little or no returning, when, if they have been going to the fields for nectar for several days, they will be almost sure to go back. It is, therefore, advisable to wait for a spell of rainy or cool weather when the bees can not fly much, during which time they will have been confined for at least four or five days. Then in the cool of the morning the nuclei can be moved to their permanent winter stands. At the moment of uniting it is advisable to use plenty of smoke, not only to avoid any possible fighting that may occur, but to disorganize them so that, when they seek flight from their new home, they will mark their entrance anew. It is also important to remove the old hives after taking the bees from them to unite with other bees.

It very often happens that late in the fall one will have a lot of nuclei without any brood. If these should happen to be queenless, the bees of several of them can be shaken into a swarming-box and confined over night in a cellar or in a cool place. The intermingling of several families of bees, and confinement in a box without combs, breaks up the old family spirit that formerly existed, and almost entirely eliminates all knowledge of the old home. This lot of bees can now be apportioned out to colonies that are not quite up to standard of strength as follows:

In the cool of the morning, before any bees are flying, take the swarming-box out to the apiary. Previous to this, all hives to be strengthened should be marked in such a way that the apiarist can at a glance determine how many bees he shall give to each individual stand. He approaches hive No. 1. The marking on the cover shows that it can take two dipperfuls of bees. He gives the swarming-box a jounce on the ground so as to pile the bees up *en masse* on the bottom. If they are disposed to fly up, he wets them down

with a little spray—just enough to dampen their wings, and thus impede their flight. Before they can crawl up on the sides of the box, with a little tin dipper he now scoops up a bunch of bees and dumps them in at the front of the entrance. If the hive in question requires two dipperfuls, then two dipperfuls of bees it gets; and so on he distributes bees to every hive that needs them.

As a matter of precaution, every hive receiving bees like this should have its queen caged for 24 hours at least, in such a way that the bees can release her by eating out the candy or gnawing away the combs. As a further precaution, after the bees have been distributed in front of the various hives, an examination should be made in about 25 minutes to see that there is no fighting between the new family and the old.

By uniting in this way we have accomplished two things—strengthened up the colonies that are not quite up to the standard, and disposed of all the weaklings in the apiary. If the swarming-box will not hold all of them at the first time, it can be filled the second or third time until all nuclei that are too weak to winter are cleaned up.

There is still one more way of uniting to prevent bees returning, and this may be practiced even when bees are flying to the fields if the weather is not too hot. The moved hive with its bees is put on top of another with a single thickness of newspaper between. By the time the bees above gnaw a hole through, some time elapses. The confinement and the gradual uniting of the bees through the hole in the paper averts all fighting and all returning of bees to the old stand, says Dr. C. C. Miller.

UNITING NEW SWARMS.

This is so easily done that we hardly need give directions; in fact, if two swarms come out at the same time, they are almost sure to unite, and we do not know of two such swarms quarreling. One of the queens will very soon be killed, but we may easily find the extra one by looking for the ball of bees that will be found clinging about her, very soon after the bees have been joined together. A swarm can almost always be given, without any trouble, to any swarm that has come out the day previous; and if we will take the trouble to watch them a little, we may unite any swarm with any other new swarm, even if it came out a week or more before. If inclined to fight, smoke them as before explained, and make them be good to the new comers.

UNITING BEES IN THE SPRING.

As we have pointed out elsewhere, uniting two weak colonies in the spring is usually unprofitable.* When there are two little weak colonies, or nuclei, one having a queen, it would seem the most natural thing in the world to put the two together for additional warmth and to provide a queen for all the bees; but, unfortunately, theory is not here borne out by facts. We have united nuclei in the spring; and while at the very time of uniting they would seem to make up a fairly good colony, yet in two or three days there would seem to be just about as few bees as there were before the uniting took place.

A nucleus from an out-apiary can be brought home and united with a nucleus at the home yard, or at any other yard. There would be no returning of bees then, and the two clusters will stay together, sharing each other's heat and enjoying the privilege of having a queen over all.

THE ALEXANDER PLAN OF UNITING WEAK COLONIES.

During the year 1905, and again in 1906 and '7, a good deal of interest was manifested through *Gleanings in Bee Culture* in the Alexander plan of uniting a weak colony to a strong one in the spring. Many of those who followed the method were very successful. A few, however, failed. To these latter we will refer later. The Alexander plan of uniting is given by Mr. Alexander himself as follows after he had carefully revised it:

ALEXANDER METHOD OF BUILDING UP WEAK COLONIES IN EARLY SPRING.

About six or seven days after taking the bees from their winter quarters, pick out and mark all weak colonies, also the strongest ones, marking an equal number of each; then all weak colonies that have a patch of brood in one comb about as large as your hand. Set all such on top of a strong colony with a queen-excluder between, closing up all entrance to the weak colony except through the excluder. Then there are those that are very weak that have only a queen, and perhaps not more than

* Uniting a weak to a medium colony is quite a different thing, as will be presently explained.

a handful of bees with no brood. Fix these last named in *this* way: Go to the strong colony you wish to set them over, and get a frame of brood with its adhering bees, being sure not to take their queen; then put the queen of the weak colony on this comb with the strange bees, and put it into the weak hive; leave them in this way about half a day; then set them on top of the strong colony where you got the brood with a queen-excluder between. Do all this with very little smoke, and avoid exciting the strong colony in any way. If a cool day, and the bees are not flying, I usually leave the strong colony uncovered, except with the excluder, for a few hours before setting on the weak colony. The whole thing should be done as quietly as possible, so that neither colony hardly realizes that it has been touched. When the weak colony has been given some brood, and put on top in this careful and still manner, hardly one queen in a hundred will be lost, and in about 30 days each hive will be crowded with bees and maturing brood. Then when you wish to separate them, set the strongest colony on a new stand and give it also some of the bees from the hive that is left on the old stand, as a few of the working force will return to the old location, especially if they are black bees or degenerate Italians.

In every case that has come to my notice where this method has been reported a failure it has been from one of two causes—either lack of brood in a weak colony to hold the queen and her few bees in the upper hive, or smoking the strong colony so that, as soon as the weak one was set on top, the bees from below would rush up and sting every one above. Therefore avoid using smoke or doing any thing to excite the strong colony.

If done in a careful manner the bees in the lower hive never seem to realize that any strangers have been put above them, and they all work in harmony together.

At the outset we spoke of those who met with failure in following the method. As Mr. Alexander says, the difficulty doubtless arose from the fact that they failed to put brood along with the weak nucleus to hold the queen and her few bees, or else the uniting was so clumsily done that it stirred up both lots of bees, with the result that they came together before they had the same scent. Mr. Alexander's injunction is to put the bees together so carefully that the clusters do not really unite for some two days, at which time there is a peaceful union, and the two queens go on laying so as to make up one rousing colony, which can be divided, making two strong colonies where before there would have been only one, since the nucleus left to itself would have died.

Where one desires to proceed with extreme caution he is advised to put a wire-cloth screen between the two lots of bees at the time of uniting, and keeping it there for two or three days, after which its place is taken by a perforated zinc honey-board. In this connection we would remark that the wire-cloth screen should be mounted in a wooden frame about 3/8 inch thick, and of the same outside dimensions as the hive.

While this plan of uniting contemplates performing the act in early spring, something can be done at it in the fall. Mr. Josiah Johnston, in a communication sent to *Gleanings in Bee Culture* in 1907, tells how he unites on the Alexander plan in the fall.

Some have had trouble in following the Alexander plan of building up weak colonies. I think the trouble in many cases is due to rousing up the bees and getting them uneasy before the weak colony is put over the strong one. Then the two colonies have war for a while. I always use wire cloth between the two hives and never have any trouble from the lower colony going up and killing the bees in the upper hive. For some time I have wintered my weak colonies this way, on the summer stands. Last winter I had several weak colonies, and I put them all over strong colonies, making an entrance in the back with my knife through the hand-hole of the upper hive. This should be just large enough to allow two or three bees to pass out at a time. This is done on some cloudy day after very cold weather comes and the bees have quit flying.

Last year I had a weak swarm of bees. There was just one frame of bees and a young queen. I put this frame of bees in with nine frames of honey, and put the frames in a hive and set it on top of one of the strongest colonies I had, and in February they got pretty strong, and I left them on till April; and when I set them off I had two strong colonies.

Milan, Ill. JOSIAH JOHNSTON.

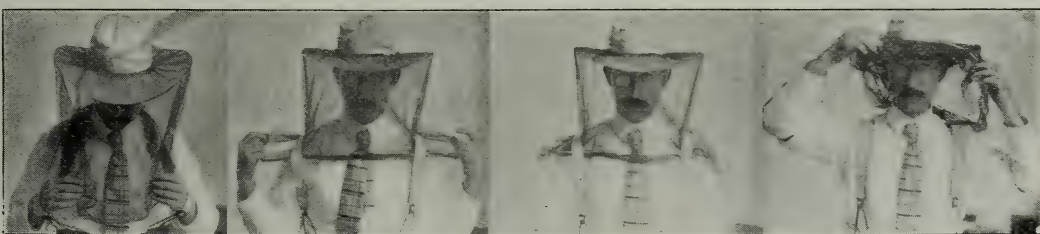
V

VEILS.—The necessity of using face protection will depend largely upon the race of bees to be handled. To deal with hybrids, Cyprians, or Holy-Lands, we would recommend one to wear a veil. With pure Italians it is not so necessary; still we always prefer to have one on the hat ready to pull down. Its use in any case gives the apiarist a sense of security to enable him to work to much better advantage than he would if continually in fear of every cross bee that chanced to buzz near his eyes.

The two objections that have been made against the use of veils are that they obstruct the vision more or less, and interfere with the free circulation of air in hot weather, and thus tend to make the wearer sweaty and uncomfortable, but these objections with a good veil are not very serious. Our best beemen, as a rule, wear a veil constantly when among the bees, and it is best to do so.

The very *nicest* veil is one made entirely of silk tulle, although somewhat expensive. The material is so fine that a whole veil of it can be folded to go in a small vest-pocket. We carry one of these constantly during the working season of the bees, and it is always ready for an emergency. It neither obstructs the vision nor prevents the free circulation of air on hot days. A cheaper one, though not so light nor cool, is made of grenadine with a facing of silk tulle net sewed in. The grenadine is strong, and the brussels-net facing obstructs the vision but little if any. The top of the veil is gathered with a rubber cord, so that it may be made to fit closely around the crown of the hat.

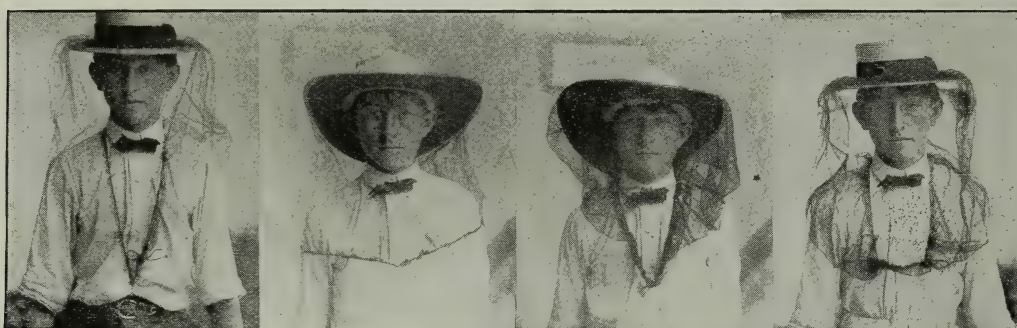
Our boys wear a broad-brimmed cloth hat, costing about 20 cents each. These hats are very light, will fit any head, and can be folded and put in a coat-pocket. The under side of the brim is green; the upper side of the crown is a drab color. This broad brim is supported and held out by means of a steel hoop, and when the veil is placed over the hat and properly drawn down it can not touch the face or neck, and hence leaves no possible chance for stings. During hot days when bees require the most attention in the apiary, a coat or vest is simply intolerable. In the absence of either one of these garments the corners of the veil may be drawn under the suspenders. The four plates herewith show successively this manner of drawing the veil under the suspenders, and its position when in use. The last view of the series shows how easily it can be drawn out from under the suspenders and raised above the hat while not in use. A few apiarists work a good part of the time with the veil raised. When the suspender method of holding is used one can raise or lower and fasten the veil in a moment's time.



Manner of adjusting a bee-veil under the suspenders where there is no elastic cord in the bottom.

But there are many who prefer a veil with a rubber cord inserted in the bottom,

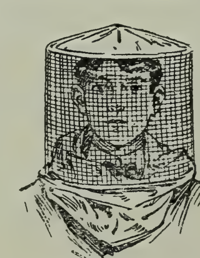
fastening the same by means of a large safety-pin to the clothing. Unlike the other veils shown with no elastic in the bottom of the fringe, this veil can be used by a man or woman, because the safety-pin can be secured to the clothing of either. But in putting this on, care should be taken to draw the elastic clear down near the bottom of the waist, securing it with a pin as shown in the first illustration. No. 2 looks very nice, but the movement of the arms will soon push the cord above the shoulders, leaving it so loose that bees can readily crawl up. No. 3 is better; and if the elastic is stiff enough very good results will be secured. But if not, the veil must be drawn down as shown in the view at the extreme left, or No. 1.



Right and wrong way to fasten a bee-veil having a rubber cord inserted in bottom.

The one to the extreme right shows a good method of fastening by means of a long string, inserted in the bottom edge of the veil. The ends are crossed in front of the waist, brought to the rear, pulled clear around to the front again, and tied. This holds the veil very securely as shown, and some seem to prefer it. An objection is that one can not very well push his hand up under the veil to get at his face to wipe off the perspiration as he can where rubber cord is used as shown, or where the edges of the veil are tucked under the suspenders. It is very important to have a protection that will secure freedom and ready access to the face. While a stray bee may get under without much danger of being stung, it is annoying to have it crawl around promiscuously. With the veil properly adjusted, one can easily reach his hand up under, pick up the bee, and at the same time be very little discommoded in his work.

The next illustration shows a wire-cloth-screen headgear that is used by some of the most extensive beekeepers in the country. It is a plain wire-cloth cylinder having a circular gathering of muslin at the top, and a sort of skirt of the same material sewn to the bottom edge. With this outfit one will be required to go bareheaded or wear a small cap. Much of the work in the apiary is done during the hottest weather, and this veil is very cool because the wire cloth rides on top of the shoulders, leaving a free circulation of air over the top of the head. In passing among trees or shrubbery it does not get "hooked," nor torn like some of the veils of fabric. It has the further advantage that it can be removed in an instant without breaking any fastening, and is quickly put on again. The muslin skirt fits loosely yet fairly snugly around the shoulders and neck. There are many practical beemen who prefer

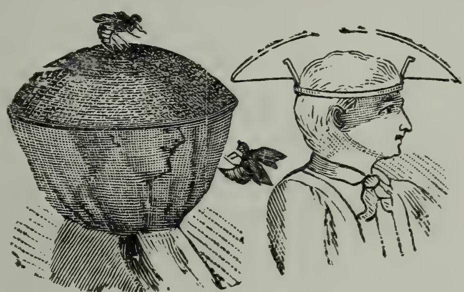


The Alexander bee-veil

wire-cloth head-protectors to any thing else. When first used they seem a little awkward; but the extreme comfort that one enjoys more than compensates for its apparent outlandishness. The one shown in the cut uses a strip of wire cloth approximately a foot wide and a yard long. A yard of muslin completes the material

required. Where one uses a coat, the skirt of this head protection can readily be tucked inside; but even without coat or vest, the loose folds of the cloth fit with a fair degree of snugness around the shoulders and neck.

One of our boys has used with much satisfaction a sort of chopping-bowl or basket inverted. It is a hat that is worn in India and other hot countries, and is



Hopatcong hat and veil.

slowly working its way into this country, particularly in the South. It is made of palm-leaf, and it is supported above the head in the manner shown above. The cut will render further description unnecessary.

As light breezes can circulate above and around the head, it is perhaps the coolest sun-shade of any herein illustrated and described. If you can not secure one of these, and would like to get the ventilating feature, take an ordinary palm-leaf hat several sizes too large. On the inside of the hat-band sew four or five $3/8$-inch corks that have been cut in halves lengthwise. These, if spaced at regular distances, will keep the hat from the head, and permit ventilation.

We have before remarked that one objection to bee-veils is the obstruction to the eyesight. To overcome this, Mr. John C. Capehart, of St. Albans, West Va., glued a piece of glass in front of the veil. The difficulty with this was, that the glass would hardly ever be in range with the eyes, on account of its weight, and then it would be covered with steam from the breath; and, worse than all, it would get broken. The brussels net is open to none of these objections, and is almost as transparent as glass itself.

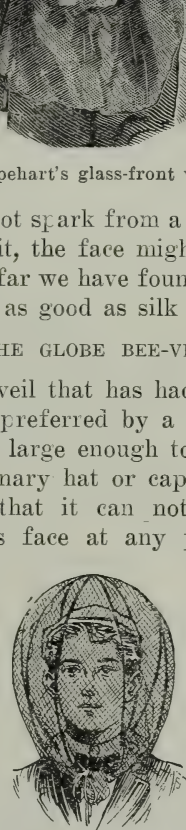
Mr. Walter S. Pouder made an improvement on this by substituting celluloid film such as is used for photographic film negatives. While this overcomes the objection of weight it does not prevent the moisture of the breath from accumulating on it. Moreover, it is very inflammable—so much

Capehart's glass-front veil

so that if a hot spark from a smoker should alight upon it, the face might be seriously burned. So far we have found nothing better than nor as good as silk tulle.

THE GLOBE BEE-VEIL.

This is a veil that has had a very large sale, and is preferred by a great number, because it is large enough to extend down over an ordinary hat or cap; and it is so constructed that it can not possibly get against one's face at any point. Some-



The globe bee-veil.

times an ordinary veil will touch one's nose or the back of his neck. At these points a bee can, if it will, insert its sting through the meshes of the veil. The globe veil is made so as to fold up compactly and can be carried in the pocket. With cross bees to handle, this is by all odds the best veil in the lot.

The Holmes headgear is simply a straw hat with a broad rim, the veil being made of mosquito-bar, and the facing of brussels net. A strip of cloth lines the lower

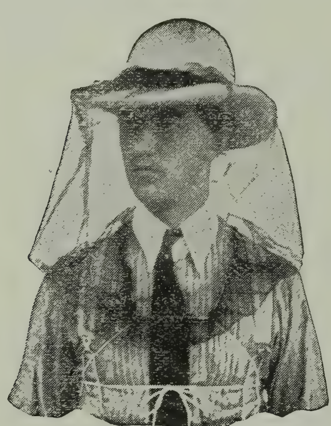
edge of the veil, and is made just large enough to fit snugly around the shoulders. A couple of cloth straps hitched to buttons pass under the arm-pits, and button

Mrs. R. H. Holmes' bee-hat

on in front. While this arrangement is good, the rubber cord and safety-pin is better.

HOW TO GET ALONG WITHOUT A VEIL.

It is a very great convenience to be *able* to dispense with a veil altogether, when circumstances permit it. The only obstacle is natural dread that a bee may possibly sting the face if it has a chance. This



Woodman's advanced bee-veil

fear will wear off as one becomes more and more accustomed to handling bees. When without a veil, if a bee comes up, and, by its hum, reveals anger, do not dodge nor strike at it, but control the muscles of the face as perfectly as though you were not at all aware of its presence. A little wince of the cheek or of the eye encourages its fighting qualities. Sometimes we put our hand up to the face when one of these rascals persists in its annoyance. Should it actually begin to sting, smash it. In your community you will probably acquire the reputation of a beekeeper, and, as such, when suddenly called upon to hive a swarm of bees without preparation for a neigh-

The Coggshall bee-veil and suit.

bor, it would be a little unbecoming, and perhaps a little humiliating, for you to show signs of fear. You should learn to "astonish the natives" barehanded and barefaced, and you need not incur risk, either, if you manage rightly.

BEE DRESS OR CLOTHING FOR BEEKEEPERS.

Under the head of GLOVES, following in its alphabetical order, will be found some long-sleeved gloves or gauntlets that reach away up above the elbows. Many beekeepers use these to keep bees from getting up the sleeve, and at the same time protect the wrists, especially the inside fleshy portions of them where they are very sensitive. Others carry this same principle further, combining the gloves and headgear all in one. The accompanying illustrations show the outfit worn by Mr. David Coggshall, of West Groton, N. Y. The lower

The Coggshall veil when not in use, but ready for emergency.

part of the blouse is taken up by a string hemmed in at the lower edge, which is drawn and tied. When not desired to use the veil it is pulled down from the hat as shown in the second illustration.

As for trousers, one can get a pair of overalls at any clothing-store, and it is suggested that he get outfits such as are used by machinists and engineers. These have numerous handy pockets, large and small, in which various tools may be placed.

Bicycle pants-guards can be used to very good advantage during extracting and all other times, when one is shaking or brushing bees off combs. The bottoms of the trousers should be neatly folded around the ankles, and the guards slipped on to hold the folds in place.

A woman should ordinarily work in short skirts or walking costume. Such a dress, with high-topped shoes, makes a very neat and becoming outfit. Some women go so far as to dress in what are called "divided skirts," the lower ends of which are fastened below the knee; and a few go even a little further and wear regular man's attire, and one can scarcely blame them for it.

VENTILATION. — Bees that are outdoors in their regular hives generally receive at the entrance all the ventilation they require. There should be, except in very hot weather, no other openings. Occasionally hives are so poorly made that they will have gaping cracks; but these, unless too large, will be closed up with bee-glue—usually along toward fall; and some strains of bees, notably the Caucasians, will close them up early in the season. Indeed, they will sometimes obstruct the entrance by means of little chunks of propolis.

In olden times it was customary for the patent-right men to furnish their patrons with hives having all kinds of ventilating holes and little trapdoors; but the modern hive, as a rule, has no openings of any sort except at the entrance, which is contracted or enlarged according to the season. In hot weather it will be opened to its maximum, and in cool weather it will be reduced to one-fourth or even less of its largest capacity. See ENTRANCES and WINTERING.

During extremely hot weather, especially during swarming time, it is sometimes necessary to provide upward ventilation in addition to that provided at the entrance. The cover may be lifted up in such a way as to leave a crack at the back end. This will allow a current of air to circulate from

the top clear down through the hive, or *vice versa.* But sometimes loosening the cover is insufficient. It is, therefore, necessary to provide ventilation for one or more supers that may be on the hive at the time. In that case, the second super is shoved forward on the lower one—just enough to leave a crack, front and rear. If that is not enough, the third super is staggered back so as to be in a vertical line over the bottom super; and in rare cases it may be necessary to go even further by tipping the cover up in addition. We much prefer to provide ventilation in this way for extremely hot weather to boring holes in the sides or ends of the hives or supers. The amount of ventilation that may be required through the top of the hive by staggering the supers back and forth will depend on how hot the weather may be at the time, and whether the hive in question is shielded from the sun. So long as the bees cluster out in front, it is an indication that there is a lack of ventilation. Sometimes a great cluster of bees will be clear over a large entrance, practically closing it up except what little air can filter through the mass of bees. In cases like this, we recommend lifting the hive up on four blocks as shown under SWARMING, sub-head "Control of Swarming by Means of large Entrances." If this does not draw the bees into the hive, provide additional ventilation at the top of the super or supers, in the manner already explained. But be careful not to overdo this, because

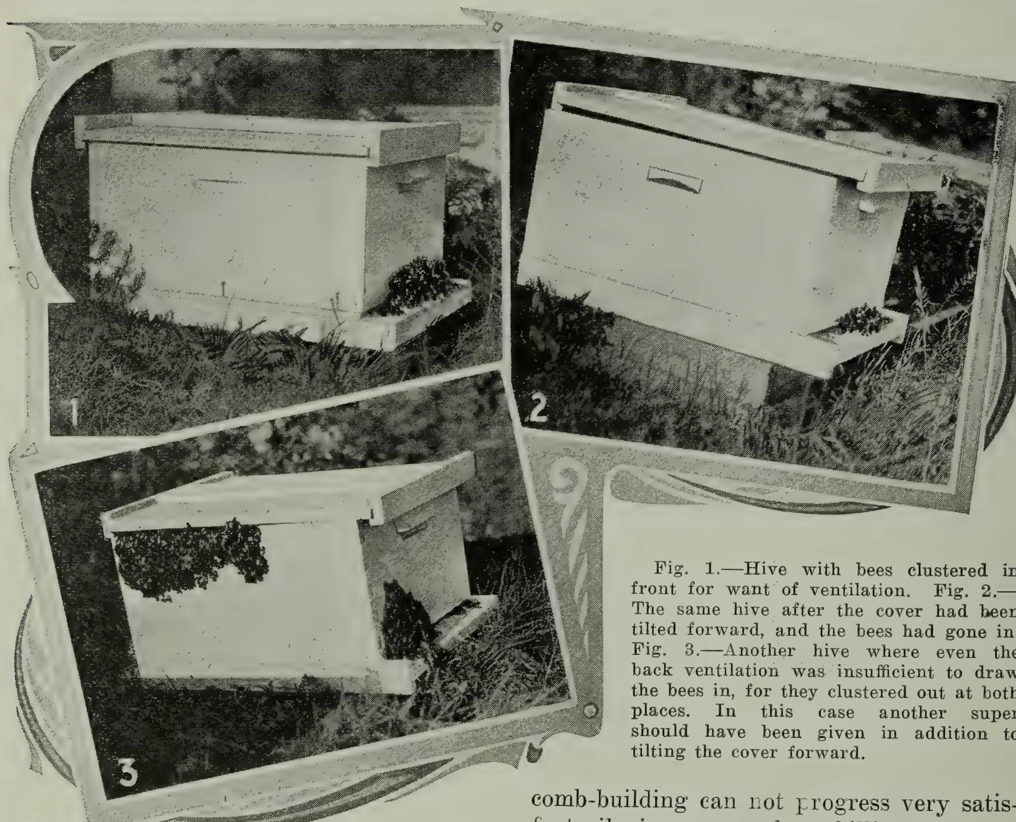


Fig. 1.—Hive with bees clustered in front for want of ventilation. Fig. 2.—The same hive after the cover had been tilted forward, and the bees had gone in. Fig. 3.—Another hive where even the back ventilation was insufficient to draw the bees in, for they clustered out at both places. In this case another super should have been given in addition to tilting the cover forward.

comb-building can not progress very satisfactorily in supers when chilling blasts go back down over the bees, and this is liable to occur at night, even after a hot day.

Under SWARMING we have shown that ventilation and swarming often stand in the ratio to each other of cause and effect; that is to say, not enough ventilation overheats the brood, causes the bees to cluster in front, induces loafing, cell-building, and finally swarming. Time and time again we have stopped this loafing on the part of a big bunch of bees in front by providing ventilation. When a colony in the height of the season can earn anywhere from five to ten dollars, it is folly to compel the poor bees to loaf and cut down their earning capacity simply because of a lack of means

to keep their domicil cool enough so that they can go inside and go to work.

VENTILATION DURING THE WINTER.

Under WINTERING, also under ENTRANCES, we have explained that bees outdoors on their summer stands do not require nearly the amount of ventilation that is needed during the summer. Even in cold weather a strong colony should have a larger entrance than one for a weak one. See ENTRANCES.

When bees are wintered in a cellar it is highly important that the atmosphere be dry, and that there be means provided for supplying with fresh air the room where the bees are kept. Insufficient ventilation causes uneasiness; uneasiness induces overfeeding, and overfeeding brings on dysentery. See DYSENTERY. It is important, therefore, that the cellar have plenty of ventilation during the entire period of confinement, and more air toward spring than late in the fall.

Authorities disagree somewhat as to the size of entrance that bees require while in the cellar; but our experience indicates that the same size of entrance that is used during moderate summer weather is better than a large one. When we gave a large amount of bottom ventilation in the cellar we had some severe winter losses, and that was the experience of the late W. Z. Hutchinson.

In severely cold weather it is highly important to see that the entrances of the hives outdoors are not closed up with wet snow or ice. A closed entrance is almost sure to be fatal to the colonies sooner or later. It sometimes happens that dead bees clog up the entrance, and the colony dies simply because a few of its dead shut off its means of ventilation.

For further particulars on the subject of ventilation, see ENTRANCES, COMB HONEY, SWARMING, and WINTERING.

SMOTHERING BEES BY CLOSING THE ENTRANCE.

Although bees manage to get along with even a very small entrance, we should be very careful about closing the entrance entirely, in warm weather, even for only a few minutes. Many are the reports we get almost every season, of bees destroyed by simply closing their entrance while undertaking to stop swarming for a few minutes, until some other colony can be attended to. See SWARMING, ENTRANCES, and ROBBING, especially the last head, *How to Stop Robbing.*

When bees have the swarming fever, as a general thing they are gorged with honey and in a feverish state. They are like a man who has been taking violent exercise after a hearty meal, and require more than an ordinary amount of air. Their breathing-tubes are in different parts of the body, under the wings and on each side of the abdomen (see ANATOMY OF THE BEE); hence as soon as the entrance is closed, and they crowd about it, the heat of so many becomes suffocating in a very few minutes; the honey is involuntarily discharged, wetting themselves and their companions, thus most effectually closing their breathing-tubes in a way that causes death to ensue very quickly. We have known of heavy swarms being killed in the short space of fifteen minutes, when the hive was thus closed on them. The heat generated by the smothering mass often becomes great enough to melt down the combs, enveloping bees, brood, honey, and all, in a mass almost scalding hot. Bees are sometimes smothered in this way, in extremely hot weather, even when they have very large openings covered with wire cloth. In fact, we have once or twice had bees, shipped by railroad, in July and August, get hot and smother, when the whole top of the hive was covered with wire cloth. We took a lesson from this, and put wire cloth over both top and bottom of the hive, and then put inch strips across, so the hive could not be put in such a way as to cover the bottom. When thus prepared, we have sent the heaviest colonies, during the hottest of summer weather, in hives full of honey, and had no trouble. See MOVING BEES.

HOW BEES DO THEIR OWN VENTILATING.

If you watch a colony of bees during a warm day, you will see rows of bees standing around the entrance, and far inside of the hive, with their heads pointing one way, all making their wings go in a peculiar manner, much as they do in flying; but instead of propelling their bodies along, they propel the air behind them, and a pretty strong "blow" they get up

too, as you may tell by holding your hand near them. Well, if the air is very hot and close inside the hive, so that there is danger of the combs melting down, they manage to send cooling currents clear to the furthest parts of the hive, and even up a small hole into honey-boxes, when made after old-fashioned patterns. This idea is not by any means new, and those who have invented patent ventilators will tell us, with a very fair show of reason, how many bees are thus employed blowing through the hive, that might just as well be out in the fields gathering honey. We once thought so, and that ventilators were needed; but after watching the matter longer, we concluded the harm done by excessive heat was far less than that from cold drafts when they were not needed, and that it is better to let a few of the bees waste some time in the middle of the day than to have comb-building stopped entirely at night, on account of drafts caused by these thoroughly ventilated hives. The most prosperous colony we ever owned was one that was so completely enveloped in chaff that they sent a stream of warm air out of their hive during frosty nights in March strong enough to melt the frost about one side of the entrance. Of course, a stream of fresh air went in at the opposite side as fast as the warm air went out. When we can get a hive into this condition of things they always prosper; and it is on this account that we would have no other arrangement for ventilation than that furnished by the entrance. See WINTERING.

VINEGAR.*—This is one of the legitimate products of honey; and when properly made it has a quality quite superior to any other vinegar, especially for making pickles. It will not lose its strength like most other vinegars; and one can have light or dark vinegar by taking light or dark honey to make it from—at least so says R. R. Murphy, of Fulton, Ill., who has made and sold large quantities of honey vinegar. Speaking of pickles made of honey vinegar, Mr. G. W. Gates, of Bartlett, Tenn., says: "We have used no other for two years; and nearly every one who tastes our pickles asks my wife for her recipe for making them. When told that we use nothing but honey vinegar, they are surprised." Mr. E. France, of Platteville, Wis., asked the wife of one of the merchants why she always bought his vinegar; and her reply was, that the stuff from the store always ate up her pickles; but that, when she uses honey vinegar, her pickles keep, and have a beautiful fine flavor.

Notwithstanding the fact that vinegar from honey is the finest in the world, the very low price of the ordinary product from cider makes it impossible to get a very high price for honey vinegar. The length of time it takes to make it, and the quantity of honey required, would make the vinegar too high-priced to compete with the other kinds on the market. But every beekeeper always has some poorer grades, some from broken combs, washings from honey-barrels, honey-cans, etc., that will be practically wasted unless made into vinegar. The late Mr. E. France always used the washings of his honey-barrels; and this sweetened water he converted into vinegar. When we can utilize honey that would practically all go to waste, and convert it into cash, we are just that much ahead.

HONEY VINEGAR, HOW TO MAKE.

The honey-water and honey-washings should be put into a barrel with the top head taken out. To determine whether the water is sweet enough, drop in a fresh egg. If the egg will just float so as to leave a spot above the liquid, about as big as a ten-cent piece, then it is "all right," according to E. France. Another beekeeper, Mr. G. D. Black, of Brandon, Ia., uses an ordinary hydrometer, which he says he bought for 35 cents. When this sinks into the liquid so the scale registers at 11, it is of the right consistency. Next cover the top of the barrel with cheese-cloth, and let it stand in a warm place where it can work and sour. In winter it should be put into the cellar. It will take anywhere from one to two years to make good vinegar. But the process can be greatly hurried by putting in "mother" from another vinegar-barrel.

VIRGIN QUEENS.—See QUEENS.

* Bulletin by Texas Agricultural Station on vinegar-making should be obtained. It is the best treatise yet on the subject.—A. C. M.

W

WATER FOR BEES.—That bees need water has been pretty well demonstrated; but the best means of supplying them is not very satisfactorily settled. The amount of water required depends largely on rearing brood in considerable quantities, and whether their food is old, thick (possibly candied) honey, or new honey right from the fields. The latter contains usually a large quantity of water that must be expelled before the honey can be ripened. See HONEY. While the bees are gathering this thin raw nectar, as a matter of course they want less water, if any at all, besides what the honey affords them. This new honey is frequently so thin that it runs like sweetened water out of the combs when they are turned horizontally, and tastes like it. The excess of moisture is probably—for we do not have positive proof of the matter—expelled by the currents of air the bees keep circulating through the hive to take up watery particles and speedily reduce the honey to such a consistency that it will not sour. See BEE BEHAVIOR. If you examine a hive very early in the morning during the height of the honey season you will find the blast of air that comes out, quite heavily charged with moisture; and when the weather is a little cool, this moisture often condenses and accumulates on the alighting-board until it forms a little pool of water. Where the alighting-board was of the right shape to retain water, we have seen it so deep as to drown bees passing out. These bees, it would seem, at least were in no need of water.

In this connection we should state that there is another way in which bees get rid of the excess of water from nectar. This interesting process has already been described under the head of FEEDING, subhead "Feeding Outdoors." But as A. I. Root was one of the first if not the *very* first to make the discovery, we give right here his own language as he then gave it to the public nearly forty years ago.

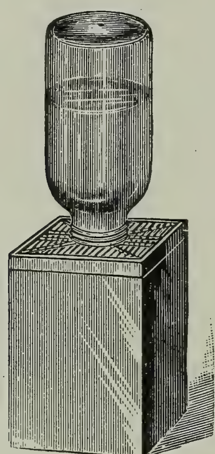
I will mention another way which, as I have discovered, the bees have of expelling the liquid portions from very thin honey. I guess I will say it is the way in which I *think* they do it, for I may be mistaken. I had several colonies in a small greenhouse for experiment. They were fed on sweetened water until they stored a large amount in their combs. When the sun warmed up the air in the morning, they would come out in great numbers and sport in the sunshine; and by taking a post where they came between my eye and the sun, I distinctly saw them discharge from their bodies what seemed to be only pure water. These bees had been fed until they had their hives so full of the thin syrup that they had even crowded out the eggs. When coming out of their hives, they seemed heavily laden; but those returning were so much reduced in size as to make quite a contrast to those going out. By watching the matter it seemed quite plain that they took the thin food into their stomachs, and, after a time, longer or shorter, were able to expel the liquid portion while on the wing, and then return the thick portion to the cells. If I am in error in this, I should like to be corrected. It may be well to state in this connection, that honey, no matter how thin, will never sour while in the hive, under the care of a sufficient number of bees; but if a comb of this thin honey be taken away from them, and kept outside the hive, it will sour very quickly.

Admitting that bees need water when they are not getting it from nectar, how shall we give it? If there is a creek or a pond within a few rods of the apiary do not fuss to make any watering-place, as, nine times out of ten, bees will ignore what we prepare for them. But where there is no water-trough, creek, nor pond within easy reach it may be well to give the bees two or three watering-places in or near the apiary. The best arrangement is a grooved board having an inverted glass or stone jar on it, as seen in the accompanying illustration.* The water will run down and fill the grooves as fast as the bees remove it, on the atmospheric principle; but as it is difficult to make such a board, one can, in lieu of it, use a dinner or pie plate. Fill the jar full of water; lay across its mouth two strips of wood 1/8 of an inch thick and 1/2 of an inch wide. On top of this jar set the plate, upside down. Next, place the right hand on the bottom of the plate, then with the left hand grasp the jar. Now

* Here's another of my babies. Cork chips an inch deep on a tub or pail of water will make a far and away better watering-place than the one here recommended.—C. C. M.

invert the whole thing. The water will bubble out immediately till the plate has a depth of water of about ⅛ inch, or whatever the thickness of the sticks is. Set the device in a convenient spot near the apiary; and to prevent the bees drowning lay little strips of wood in the water. If previously salted a little, this water serves as an additional attraction.

Let it be distinctly understood as entirely unnecessary to go to all this trouble, providing bees can get water in abundance



Watering-jar and board, or open-air feeder.

from some pump, creek, or pond, as mentioned. If, however, there are neighbors who complain about the bees congregating about their pumps or troughs, it may be well to fix up counter-attractions such as jars of water slightly salted, to draw the bees away.* In addition to this, take a pail of water and put into it a tablespoonful of commercial carbolic acid. Stir it well, then spray or spatter this water around the pump of your neighbor who complains of your bees. As explained under ROBBING, bees seem to have a great aversion to carbolic acid; and where a solution of it is sprinkled they keep entirely away.

WAX.—This is a term that is applied to a large class of substances very much resembling one another in external characteristics, but quite unlike chemically. The wax of commerce may be divided into four general classes: Beeswax, familiar to us all; mineral wax, or by-products from petroleum; wax from plants, and wax from insects other than bees. But the first two are by far the most important commercially, in this country. Of the mineral waxes we have what is most common, viz., paraffine and ceresin. Beeswax is the most valuable, and has a specific gravity of between 960 and 972, and melting-point of between 143 and 145 degrees F. The mineral waxes vary so much in hardness, melting-point, and specific gravity, that it would be useless to name exact figures. As a rule, however, it may be stated that the fusing-point of paraffine is much below that of beeswax, while that of ceresin may be either above or below, or practically the same. In general, we may say that the specific gravity of both commercial paraffine and ceresin is below that of beeswax; which fact renders it an easy matter to detect aduleration of beeswax with either paraffine or ceresin, by a method that will be explained further on, under the head of ADULTERATION OF BEESWAX.

There are also known to commerce Japanese wax and China wax, both of which may or may not be the product of insects or plants. As they are so much more expensive than either paraffine or ceresin, little fear need be entertained of their use as adulterants of beeswax.

BEESWAX.

For the bees and their keeper, no product has ever been discovered that can take the place of that which the bees themselves furnish. Real beeswax retains ductility and tenacity under greater ranges of temperature than any mineral, plant, or insect wax. Combs made from foundation containing 25 to 50 per cent of adulteration of paraffine or ceresin are very liable to melt down in the hive in hot weather. Paraffine is ductile enough to make beautiful foundation, but does not stand the heat of the hive. Ceresin, on the other hand, while more closely resembling genuine beeswax in point of specific gravity and fusibility, is too tough and brittle, under some conditions, for bees to work. Work it? Yes, they *will*, and construct combs; and in Germany we understand that considerable ceresin foundation has been and perhaps is being sold now; but our experience leads us to believe that it is poor economy, and

* It is important to get your own watering-place started early, before the bees get in the habit of going to the wrong place.—C. C. M.

will lead the beekeeper or the poor bees to grief sooner or later. Practically, then, we can say that genuine beeswax is the only product that ought to go into foundation; and we are glad to say that it is the only article that foundation-makers in this country use.

BEESWAX IN THE ARTS.

Under the action of the United States pure-food law that went in effect June 30, 1906, beeswax will have much larger use than ever. Indeed, there is already a notable increase in the price. Druggists (thousands and thousands of whom in the country formerly used paraffine, ceresin, and the like) will now be *compelled* under the new law to use nothing but pure beeswax, and the amount will run up into the hundreds of thousands of pounds. But what use have druggists for wax? They require it in making plasters, certain kinds of ointments, and for certain medicines known to the pharmacopœia.

There has always been a large use for paraffine and ceresin in making candy; but now this must cease, while beeswax will be permitted as before. These two industries alone will increase the demand for the product of the hive to a great extent; and while we do not expect an immediate advance in the price of wax over and above what has already taken place, the time is not far distant when beekeepers having dark honeys will do well to consider the possibility of making wax-production a business.

The new pure-food law will have no effect one way or the other on the use of paraffine, ceresin, and the like in any compound or mixture that do not belong either to the food or drug classes. Electrotypers can use a substitute for taking impressions, although the great majority, we understand, prefer pure beeswax, even at a higher price. Natural-wood finishers can still use paraffine and ceresin; but most of them assert that there is nothing to compare for that purpose with pure beeswax. The first mentioned gives a greasy, smeary finish, while the product from the hive yields a highly polished surface—one that stands wear as nothing else will; a finish cheaper than hard oil—not by the gallon, but to apply.

The Roman Catholic Church uses large quantities of beeswax in the form of candles. She does not tolerate paraffine, ceresin, nor any of the mineral waxes, all of which give off an offensive greasy odor while burning, whereas candles made of beeswax leave a delightful perfume. Then, too, the burning of mineral wax causes a deposit that injures pictures, while beeswax mellows and preserves them.

Certain grades of blacking, harness oils, and lubricants require pure beeswax in their manufacture. A blacking containing beeswax will withstand more dampness than that made of any other substance.

The electrical-supply business is a consumer of our product. The windings of the wire are soaked in paraffine or beeswax—preferably the latter, because it seems less affected by extremes of heat and by moisture. Pattern-makers also use beeswax. The profession of dentistry consumes large quantities of pure wax every year to take impressions of the mouth. Last, but not least, the beekeeper is a large consumer as well as a producer of wax.

In all the arts, paraffine, ceresin, and certain other mineral waxes can be used; none of them have all the desirable qualities furnished by the product from the hive.

HOW BEES "MAKE" WAX.

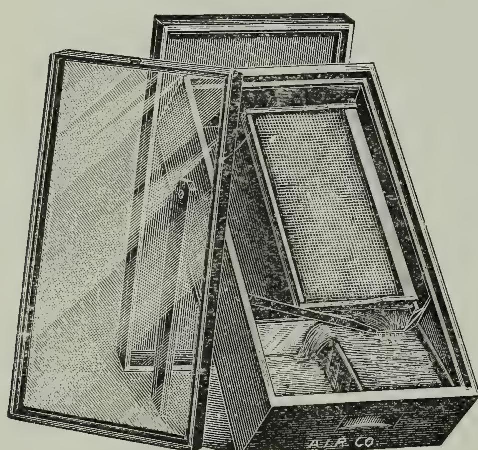
If you watch the bees closely during the height of the honey-harvest, or, what is perhaps better, feed a colony heavily on sugar syrup for three days during warm weather, toward the end of the second or third day, on looking closely you will see little pearly disks of wax, somewhat resembling fish-scales, protruding from between rings on the under side of the body of the bee, which, examined with a magnifier, reveal little wax cakes of rare beauty. Sometimes, especially when the bees are being fed heavily, these wax scales fall on the bottom-board and may be scraped up in considerable quantities, seeming for some reason not to have been wanted. During the seasons for natural secretion of wax, where the colony has a hive affording plenty of room for surplus we believe wax scales are seldom wasted. At swarming-time there seems to be an unusual number of bees provided with them; for when bees remain clustered on a limb

for only a few minutes, bits of wax are attached, as if they were going to start comb. When domiciled in their new hive, comes the time, should it please them, to show astonishing skill and dexterity in fabricating honey-comb.

WAX-RENDERING.

SOLAR WAX-EXTRACTORS.

It is said the sun wax-extractor was originated in California about the year 1862. At that time it was used for extracting honey from the combs. The honey-extractor



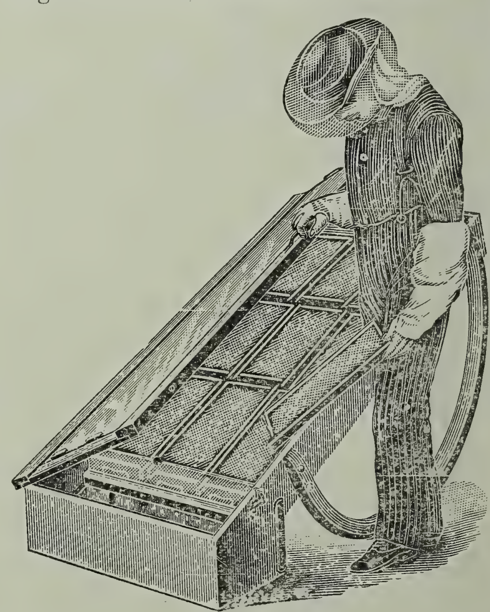
The Doolittle solar wax-extractor.

of to-day being then unknown, it is related that the early Californians extracted their honey largely by means of the sun's heat. They simply placed their cards of comb in large trays covered with glass, where old Sol, by the mere beaming of his countenance, did the work. As the combs melted, the honey and wax ran together into a receptacle. In the evening the wax, by reason of its lighter weight, was floating on the surface of the honey, and hardening. The Californians thus practically accomplished two objects at one and the same operation—extracting both honey and wax —the latter already in marketable shape. As to the quality of the honey so separated from the combs, it is much better than one would suppose, but inferior to the ordinary extracted. Recently the use of the solar extractor has been restricted to the melting of wax.

To a casual observer it seems almost incredible that wax can be melted by the aid of the sun. It is well known to the beekeeper that little scraps of wax in summer weather will melt on a hive-cover exposed to the direct rays of the sun. If, therefore, we cover a shallow box with a sheet of glass, and place therein a piece of comb, it will utilize a much larger percentage of heat. Still further, by collecting more rays of the sun, and casting them into the box by means of a reflector (a sheet of tin, for example), a correspondingly greater increase of temperature may be expected. The reflector, however, is unnecessary, as sufficient heat is obtained without it.

This machine has had a very large sale. Its general design is after a pattern made and used by the well-known beekeeper G. M. Doolittle. The only objection to it is that it is rather small, but just the right size to take pieces of burr-comb and other bits of wax, etc., that accumulate in everyday working of the apiary. These accumulations can be thrown into the machine whenever one happens to pass by it; and instead of having a lot of little pieces scattered here and there through the apiary, to be melted up at some future time, they may be converted at once into a marketable product.

These small machines are not suitable for melting up combs. For that, something as large as the Boardman should be used.



The Boardman solar extractor.

This is built very much on the same general plan as the one just described, but is

larger. The rockers, or runners, afford facility for transportation, and also for tilting the machine at the proper angle to the sun. Common greenhouse sash may be used; but a large glass, say 30 x 60, is better for the reason that the sash cut off a good deal of the sun's rays, making shade-lines along which the wax fails to melt.* The size of glass that one is able to buy will, of course, regulate the size of the extractor; the depth of the box, or tray, may be anywhere from 6 to 8 inches, the bottom being made of cheap lumber. This box or tray should be lined with common black sheet iron. Tin should not be used, because it reflects back too much of the sun's light. The whole tray, including the frame for the glass, should be painted black; and the glass, while the machine is in use, kept scrupulously clean.

SOLAR WAX-EXTRACTORS NOT SUITABLE FOR OLD COMBS.

Solar wax-extractors have their use to handle *new* combs, particles of fresh wax, pieces of burr-combs, and the like, and can be used to clarify and bleach to a certain extent wax already caked, but are not adapted to the handling of old black combs that have several generations of cocoons in them. Large sun extractors like the Boardman will get the bulk of the wax out of such combs, but they do not get *all* of it. If sun heat is used at all for melting, the slumgun (or refuse) should be further treated.

RENDERING WAX FROM OLD COMBS.

For new combs the problem of rendering wax is a comparatively simple one, since the operation consists simply in melting them in hot water and dipping the wax off the top. This is true also of cappings where the total amount of refuse or impurities is so small that there is practically no difficulty in getting all the wax. Here a solar wax-extractor is satisfactory, although not to be depended upon for speed nor great capacity unless very large, which would be expensive. When old comb is to be rendered, on the other hand, the problem becomes much more difficult, as the many layers of cocoons found in the cells used for brood-rearing confine the wax and make it hard to remove. It can be readily seen that, if old comb is simply melted in hot water or steam, these cocoons will become saturated with wax, making the loss very great. The following discussion, therefore, will have to do especially with the difficulties encountered in rendering wax from old combs.

There are many different methods practiced by beekeepers all over the world to obtain the wax from old brood-combs; and it is needless to say that, in many of them, the loss is considerable. One of the crudest methods is to throw the combs into a large iron kettle of water and then build a fire and boil the contents for several hours, skimming the wax off the top of the water meanwhile. More comb is added from time

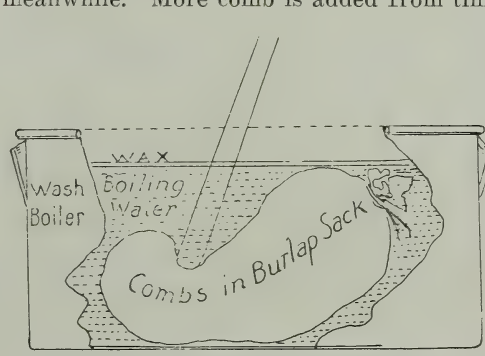


Fig. 2.—A very crude and wasteful method of rendering.

to time, and the process is continued perhaps all day. Finally a piece of wire screen is weighted down on the refuse to keep it out of the way and facilitate dipping the wax. Careful experiments have shown that this method wastes from 25 to 40 per cent of the total amount of wax, while a great deal of time is required to clean and refine what little wax is secured.

Another plan which has been advocated to some extent is that shown in Fig. 2. A sack of comb is held under the surface of the water, and agitated or punched with a stick for a long time until much of the wax is released and floats to the surface, where it may be dipped off. This method results in somewhat cleaner wax; but there is apt to be nearly equal waste to the plan before mentioned.

There is another method that is used more, perhaps, than the two which have just been described. It is a somewhat better plan, for the amount of waste is not

* If the large glass can not be had, better purchase three sheets of 20 x 30, and put them in the frame crosswise—the glass butting tight up against each other.

so great. It is shown in Fig. 3. In order to get the best results the weights should be so arranged that they can be lifted up a few inches in order to give the refuse in the sack a chance to become saturated again with hot water. The weights should

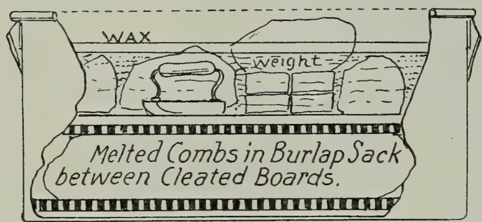


Fig. 3.—A popular but wasteful and slow method of obtaining wax.

then be lowered, and this process kept up for several hours, the water meanwhile boiling vigorously. The wax should be dipped off almost as fast as it rises to the surface.

In 1904 Mr. T. J. Pennick, of Williston, Tenn., suggested the use of centrifugal force applied to hot slumgum just taken out of boiling water. It was his opinion that the free wax, when hot, would by this means readily separate from the solid matter in a very short time. Extensive experiments have developed the fact that there would be a great deal of wax which would not escape from the refuse, no matter how fast it might be whirled in an extractor, showing that even great centrifugal force could not separate the wax from the refuse. Wax nearest the outside might be thrown out; but that nearest the center would be held back and not escape.

Mr. A. C. Miller, of Providence, R. I., some time ago devised an agitator* and applied it to the rendering of wax. The old combs in such an agitator are thoroughly stirred and rubbed under hot water so that the wax is liberated, and rises to the surface, where it is drawn off through a spout. As will be seen, this is somewhat similar to the plan shown in Fig. 2, before mentioned, although it would be, of course, a great improvement on that very crude method.

From our experiments, and from reports we have received from hundreds of beekeepers, it would seem as though the wax-press were by all means the most satisfactory wax-extractor yet devised. We doubt whether any thing but pressure combined with heat can remove all of the wax. In saying this, we realize that there will probably never be a wax-extractor of any

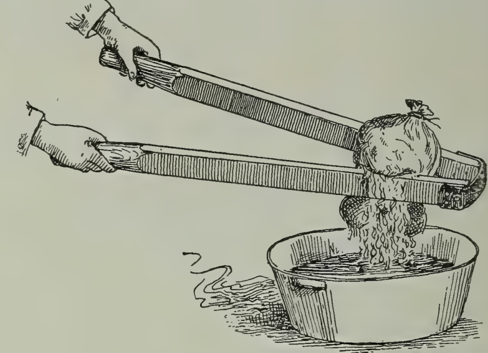


Fig. 4.—An unhandy and unsatisfactory plan.

kind that will economically remove the last particle of wax;* but if the amount of waste can be reduced to less than one per cent, the loss is an item that can be neglected.

Before entering the discussion of wax-presses it may be well to add a word of caution to beekeepers who are sure that the particular method they are using enables them to obtain all the wax or practically all. If the refuse, when they are done, has not been put through a well-constructed press we believe that there will be no way of determining the amount of waste, for it might contain as much as 20 per cent of wax and still look perfectly clean and show no traces of it when examined. On a small scale it is possible to get some idea of the amount of wax left in refuse by the following very simple plan:

Thoroughly heat in boiling water the refuse to be tested, then allow it to cool slightly; seize a large handful, and squeeze it as much as possible in the fingers. If fine lines of wax appear in the creases between the fingers a good deal of wax is left—perhaps from five to ten per cent or more, depending upon the amount of wax shown. The hand will not be burned in the very short time necessary to make this test. But, as before stated—the most conclusive method of determining the waste is

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* It released all the wax, and lots of dirt and coloring-matter.—A. C. M.

* "Less than one per cent" is virtually (commercially) all. Only chemical treatment would get *all*.—A. C. M.

to run the refuse through a well-constructed press.

HOT-WATER WAX-PRESSES.

In these presses the pressure may be continued without the least danger of chilling the combs. This method has also a decided advantage in that the screw can be raised after having been turned down, and the cheese allowed to become saturated again with boiling water. This is quite an advantage. The screw may then be lowered, and this hot water forced out of the refuse, carrying with it more of the wax. This operation must be repeated as often as found necessary by experience. It is thus seen that there is no disagreeable handling of the refuse until all the wax is out. Furthermore, the work, if necessary, may be confined to the one tank.

Mr. Orel L. Hershiser, of Buffalo, N. Y., devised the hot-water press shown in Fig. 5. The capacity of this is large, so that it is possible to obtain as much as 75 pounds of wax in one day over a common stove. One great objection to hot-water presses heretofore has been their relatively small capacity of wax per day. Mr. Hershiser, by making the press very large, overcomes this difficulty.

The quality of wax from hot-water presses is usually not very good, because of the long-continued high temperature. In the Hershiser press more hot water is introduced at short intervals into the lower part, causing the melted wax to overflow through the outlet at the top. In this way the wax is not left for any great length of time on the boiling water, so that the color is not darkened.

Perhaps one objection to hot-water presses is the cost of the outfit; but for extensive beekeepers we believe that they are the most practical, as somewhat cleaner work can be done, owing to the long-continued intermittent pressure on the refuse surrounded by hot water. In other words, old combs rendered in a hot-water press may be pressed as many as fifteen or twenty times, so that it is possible to reduce the final loss to only a fraction of one per cent.

If one wishes to try the hot-water method by using an outfit constructed at home he can follow the plan shown in Fig. 6. An ordinary kettle may be used, although it would be advisable to have one with a flat bottom. As it would be rather difficult to construct a cross-beam over the kettle rigid enough to stand the pressure exerted by a screw, a lever had better be used as shown, though some means will have to be employed to keep it from falling over sidewise, such as a loop around a tree or post. In using a lever it is important to have it so adjusted that the pressure will be uniform and directly downward. Any pressure exerted from a point not directly over the kettle will result in pressing the refuse to one side, so that the "cheese" will be very thin on one edge and very thick on the other. If this were the case there would, of course, be too much wax left in the thick portion. To get the best results the cheese should not be over an inch or an inch and a half thick after pressing.

Cleaner work can be done by an intermittent than by continuous steady pressure; and so, whether using a lever or screw, it

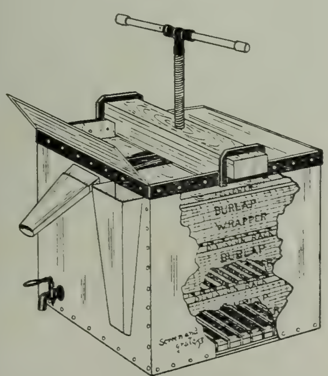


FIG. 5.—Hershiser hot-water wax-press.

FIG. 6.—Use of the lever in pressing wax.

is well to relieve the pressure about every ten minutes, allowing the cheese two or three minutes in which to become thoroughly saturated again with boiling water. Pressure should be applied slowly at first in order to avoid bursting the burlap.

With the outdoor-kettle plan the wax will be discolored on account of the long-continued heat unless it is dipped off the surface of the water almost as fast as it rises. About three hours of intermittent pressure for one batch of combs in a kettle will render out the wax.

STEAM-PRESSES.

Methods of rendering wax, embodying the principle of applying great pressure to combs surrounded by steam, are quite old, both in this country and in Germany, where they originated. In many ways steam-presses have advantages over other

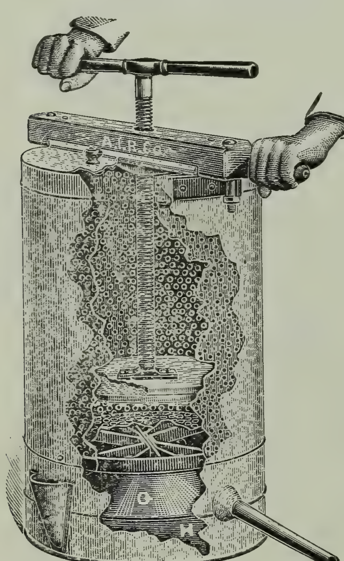


FIG. 7.—German steam wax-press.

methods; but the quality of wax is usually not so good, because of the high temperature to which the comparatively thin surfaces of melted wax are subjected; although the wax, as it leaves the refuse, falls down out of the way so that the work can be much more conveniently carried on, since there is no great depth of water in the way.

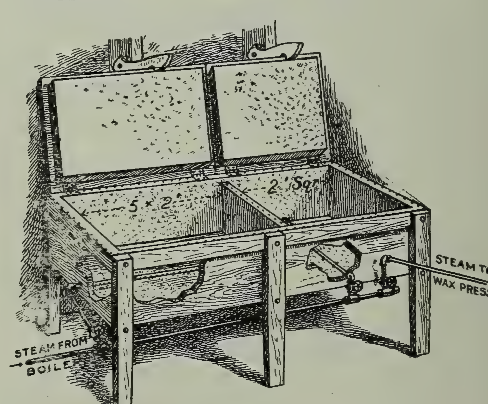
A steam-press of popular design is shown in Fig. 7. Steam is generated under the false bottom G, of the compartment H, and, passing upward through an opening in the center of the false bottom, surrounds the combs beneath the plunger in the perforated metal basket. As the wax, falling from the refuse can not get into the water on account of the false bottom, it passes out of the tube shown.

Steam-presses are very convenient as uncapping-cans; for when the perforated metal basket is full of cappings the cross-arm can be placed in position, the screw run down, and practically all honey forced out. Then steam may be generated, and the wax melted into marketable shape without any second handling and with little extra trouble; or the "cheese" of cappings, pressed nearly dry of honey, may be stored away to be rendered into wax at a more convenient time later.

These presses are also very useful in pressing honey from broken combs, unfinished sections, etc., and rendering the pressed comb into wax.

Mr. Edward G. Brown, of Sergeant Bluff, Iowa, has described an excellent plan for rendering wax on a large scale, making use of an open press heated with a steam-jet. Where one has access to steam this is a very practical method. His plan in full is as follows:

The wax-rendering apparatus which I use is somewhat beyond the reach of many beekeepers; but it gets the wax, and I think a little nearer all of it, than most of the various outfits in use. I will give the figures of the wax rendered, and later describe the apparatus.



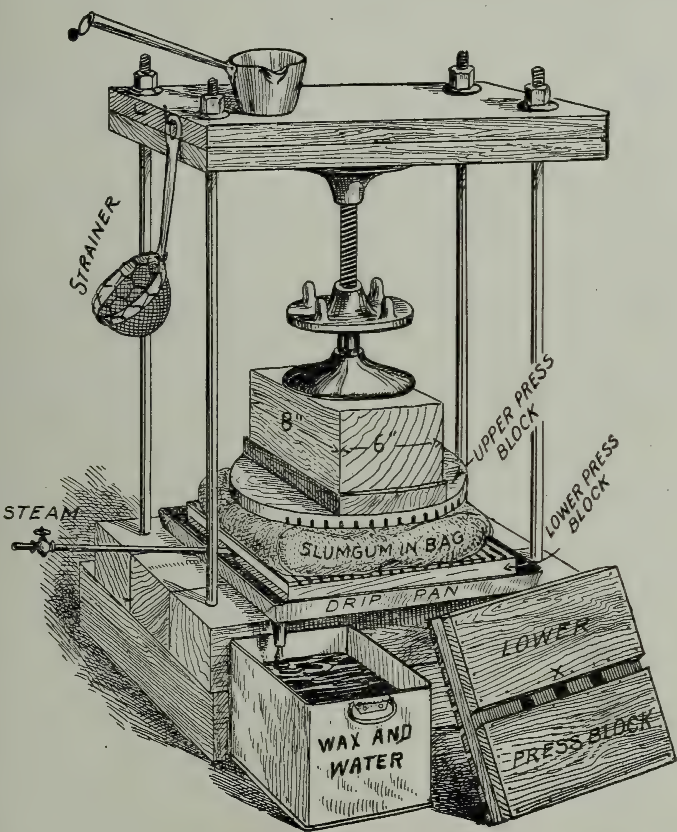
Steam-heated vat for melting old combs.

The best results which we have secured were from a lot of combs, many of which were 25 years old. There were 400 of these combs in the lot, and we obtained 164 lbs. of wax, or a little over 4 lbs. of wax to every 10 combs. There were two working at the job, and the total time for rendering, including firing up the boiler, etc., was a little less than five hours. We have made a few full-day runs on combs varying in age from one to twenty-five years, and the results average about 250 to 375 lbs. of wax

to the thousand combs. In a day we can usually render from 800 to 1000 combs, the number depending, of course, upon the condition of the combs, etc. When I buy old combs I usually figure on about 2½ lbs. of wax to the hive of ten combs, Langstroth size.

In the last two years we have rendered something like 8000 or 9000 combs on account of foul brood, and I believe that this is the only way to eradicate the disease completely from a yard when it once gets a start. There is just one other way; and that is, to build a bonfire and burn up all the supplies, etc., in connection with the yard. Incidentally the latter plan is somewhat expensive, for it leaves the apiarist at the foot of the ladder, ready for a new start.

The figures given above may seem a little large



Brown's wax-press for wholesale work.

to some; but the apparatus is of fair size, and requires two to work it at full speed, and a part of the time there were three of us. Our work-shop is an old cheese-factory which I also use for storage room; and the heat for the wax-rendering is furnished by a big boiler from which I also get the power for running my buzz-saws, as I make all my own hives and heavier supplies.

The engraving shows the various parts of the tank, which is 2 ft. wide, 7 ft. long, 16 in. deep. It is divided into two parts, as shown, both parts being lined with galvanized iron, and fitted with a cover of the same material. Each part is about half filled with water; and steam for boiling the water is introduced by means of a ¾-inch pipe, on the under sides of which holes are drilled so that, when the steam is turned on, the contents of the tank are kept in motion. Each division of the tank has a separate pipe controlled by a valve so that heat can be applied when wanted, and as hard as desired. The press as shown in the second engraving is made from an old cheese-press. The construction is sufficiently clear, hence no detailed description is necessary. A pipe is arranged under the press in such a way that steam may be forced between the cleats of the bottom of the press, thus keeping the slumgum hot.

Two pieces of heavy burlap are used for holding the slumgum, the outer one being about 30 by 30 inches, and the inner one about 20 by 20. These are laid over a form 10 inches square and 4 inches deep, which will hold about two gallons of the melted combs. After the comb is dipped in the sides, the cloths are folded together, then the form is removed, the upper block placed in position, and the pressure applied. Unless these sacks are of extra good quality they do not last longer than eight or nine times, and even the best ones usually burst after fifteen or twenty pressings. A short-handled pitchfork, a wire strainer, and a number of 50-lb. honey-cans with the top cut out, to be used as molds, complete the apparatus.

When rendering, the tanks are filled about half full of water brought to a boil by the steam. The larger compartment is then filled with combs still in the frames. About 50 frames of combs can be put in at once. The cover is then shut down and the steam turned on. From three to five minutes is required to do the work, and when the contents are boiling thoroughly the cover is raised and the steam partly turned off, so that the frames may be swished about in the water and finally picked out with the pitchfork. The steam is then turned off, and the slumgum skimmed by means of the strainer into the small division of the tank, when a new batch of frames containing combs may be put into the first or larger compartment.

While one man works at melting up the combs and tending the fire under the boiler, the other is kept busy working the press. The room is so hot and full of steam that the operators can wear but few clothes, and even then it is rather hot work.

The slumgum which is kept boiling is dipped from the small compartment of the tank into the burlap in the press, and the wax is run into square cans or molds. The frames as they come from the tank are washed cleaner than they could be scraped with a knife, and from experiments which I have made they are entirely free from any disease. We have not been able to make it pay to rerender the refuse from the press; but with what wax and propolis are left in the cheeses they make good fuel and furnish nearly enough fire to keep up steam. The cheeses are dumped directly into the boiler room, and are burned.

During the year 1907 we rendered about 1500 lbs. of wax, and in 1908 nearly 1100 lbs., so we think we have had quite an opportunity for testing the apparatus thoroughly.

UNHEATED PRESSES.

Mr. C. A. Hatch, of Wisconsin, was probably the first one to make extensive

use of this method of wax-rendering. He had used for a short time a press designed by W. W. Cary, of Massachusetts, in which the combs were pressed while submerged in hot water; but he believed that he could improve on this plan by applying pressure in a different receptacle without the use of so much hot water. Later Mr. F. A. Gemmill, of Ontario, Canada, also used such a press, which finally came to be known as the Hatch-Gemmill wax-press. This is shown in Fig. 9.

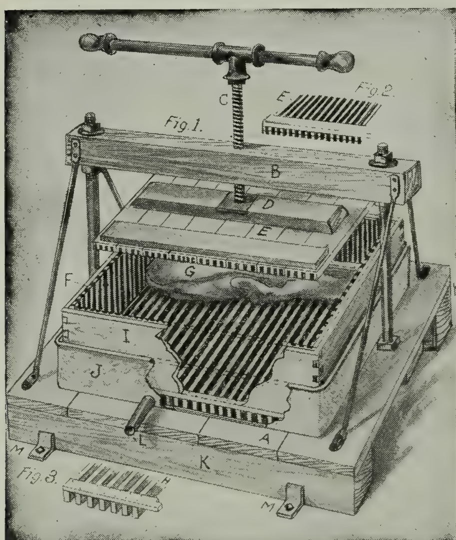


FIG. 9.—The original Hatch-Gemmill wax-press.

Wax-presses very similar to the Hatch-Gemmill have been constructed and used by various beekeepers all over the country. Since the essential features of this method have been in use so long it is very evident that the unheated press has merit. The authors of this work have rendered large quantities of wax, and have made many experiments which all go to prove that the unheated press is a most desirable one for the average beekeeper.

Mr. F. A. Salisbury is an enthusiastic advocate of the unheated press. The form which he likes best is shown in Fig. 10. It will be seen that the loss of heat is prevented by having no circulation of air; hence, since wood is an excellent non-conductor, the combs remain hot for a considerable length of time. The construction is sufficiently clear from the illustration.

The particular form of unheated press preferred by the authors is shown in Fig. 13. It will be noticed that a round can, constructed of tin, is used instead of the square wooden box and tray shown in Fig. 9. The principal reason for this change is that it is easier to keep the cheese from bursting out sidewise when a round box or can is used, for the square box tends to bulge out in the middle, thus allowing the burlap to burst. If a round can is used, the pressure sidewise is always in a direction directly away from the center, and the horizontal pressure is thus equalized. With the round can the cheeses do not chill so quickly as they do in the square box, for the reason that they are more compact, and there is always less chance for cold air to circulate around under the cheese. Mr. Hatch now uses two screws instead of one, for he believes that he can get more pressure with the two; but it is doubtful if two screws are necessary, since one screw will exert more pressure than is needed, and is, besides, more easily handled.

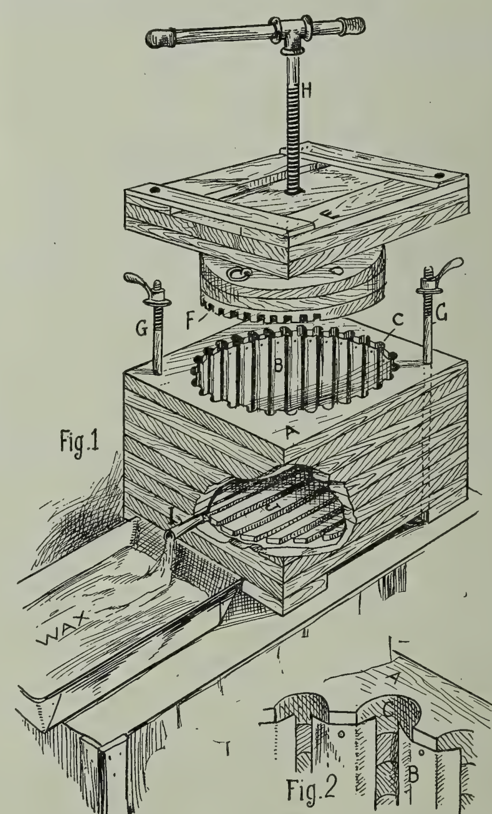


Fig. 10.—Salisbury's press, constructed almost entirely of wood.

It will be noted in Fig. 13 that the screw extends down into a hole in the center of the cast-iron follower. If the screw simply rests on the top, the follower shows a great tendency to go down sidewise, es-

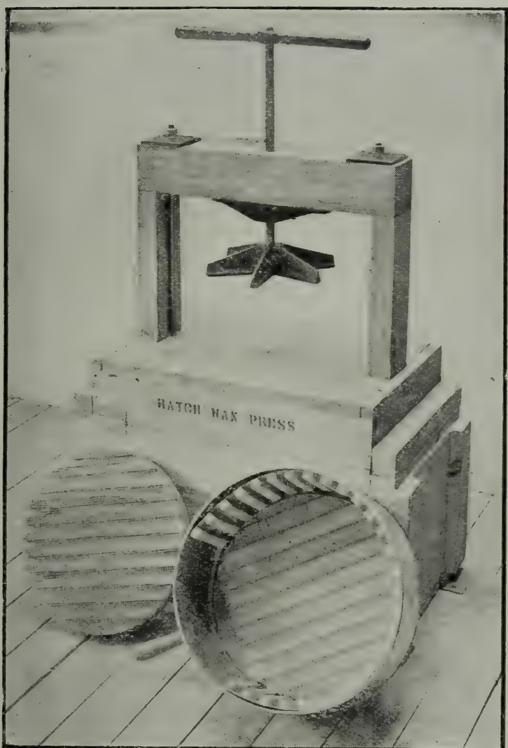


Fig. 13.—Style of unheated press preferred by the authors.

pecially if one is not exceedingly careful to place the melted comb evenly in the can. It is easy to see that, when the follower does not go down straight, one side of the cheese will be much thicker than the other, and contain quite a good deal of wax after the work is done. With this arrangement the follower must go down straight unless the screw bends; but there has never been any trouble from that source. The circular follower above the cheese must be cleated, as shown on the under side, to aid the wax and water in running off.

With this press, since there is no heat applied to the combs during the pressing, it is well to do the work in warm weather, or in some room that can be kept warm by the heat of the stove used; for when the air is cold, or when the wind is blowing, the wax has a tendency to become chilled, and the work is hindered. In warm weather or in a warm room there need be no chilling if the work is properly done. It would be a good plan to have all the apparatus arranged in order—that is, have the press near the stove, and the large can for holding the hot water and melted wax, as it comes from the press, near both. An ordinary wash-boiler on the stove may be used for melting up the combs; or faster work can be done if there are two such boilers, the second one being used for heating fresh comb while that which has already been melted in the first one is being rendered. The press should stand as near the boiler as possible to avoid the drip when the melted comb is dipped from the boiler into it. Cleats should be nailed outside of the press platform, Fig. 16, to keep it from twisting when the screw is turned, and two hinges should be screwed to the front edge, as shown, in order to allow it to be tipped up on edge when necessary, to let the wax and water drain out. It is best to have the back of the press a little higher than the front at all times.

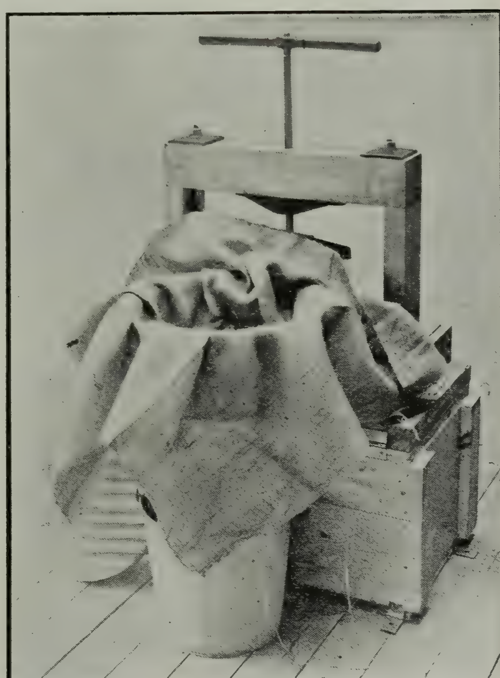


Fig. 14.—Showing can slid forward on the platform and the burlap spread out ready for the melted comb.

To begin the work, pour about two pailfuls of water into the boiler and set it on the stove. As this comes to a boil, keep adding old comb, stirring frequently. As much as half a barrel may be melted in one

boiler at a time, or even more if necessary; but it is best not to have too much comb in proportion to the water used, since this plan is essentially a washing-out process; and good results, therefore, can not be secured when there is not enough water. Keep stirring the contents of the boiler

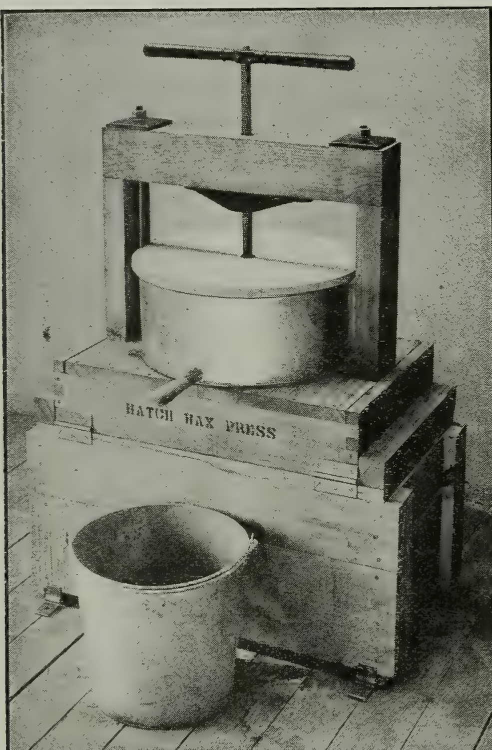


Fig. 15.—All ready for pressure.

until it has all been heated through thoroughly and has boiled until the wax has been reduced and the melted comb is of the consistency of mush; then push the boiler to the edge of the stove, where it will keep hot, but where the wax will not burn or become discolored from too high a temperature. Next put the wooden plug in the spout or tube at the bottom of the wax-press can; and after putting folded-up burlap and follower in the can, fill it with hot water. This is done to heat thoroughly the press and all the parts that would come in contact with the cheese, in order to prevent unnecessary chilling. Then remove the wooden plug and draw off the water and pour it into the second boiler on the stove, which, as before explained, should be used for melting up the second lot of comb in case it is necessary to do rapid work. Now slide the can forward on the platform, as shown in Fig. 14, and spread the piece of burlap over it. Dip about one gallon of melted comb *and water* into the press and fold the burlap neatly over it. The wooden plug must be kept in the outlet tube in order that the water and wax may not run out. In dipping in the melted comb do not use a strainer or dipper with a wire-cloth bottom, for the idea is to transfer *plenty of water with the comb* in order to keep the wax from chilling, and also to aid in washing it out. Use an ordinary dipper, then, of pretty good size. The square piece of burlap should be of such size that there will be plenty of room on top to keep the slumgum from washing out; but, on the other hand, there should not be so much as to make a great roll of useless cloth that will only be in the way. A foot on each side to fold over is enough if this burlap be folded over neatly, as one would fold paper in tying up a

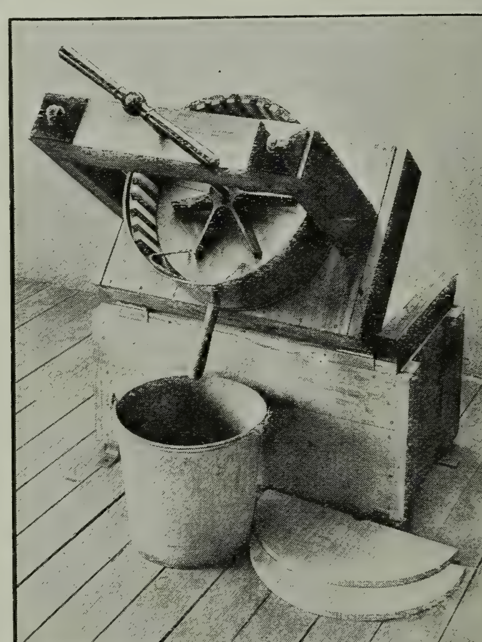


Fig. 16.—The press tipped up on edge to allow the last of the wax and water to run out.

package; there is no need of nails for keeping the edges together. Place the cleated follower on top of the burlap package of combs with the cleats running toward the spout, then push the can back under the screw. Apply the pressure slowly, turning the screw down more and more as

the wax and water are pressed out of the comb. Enough water should usually be transferred with the comb so that the cast-iron follower will be completely covered when the screw is turned down about half way. If not enough water has been dipped over, more hot water should be added; but usually, enough water can be dipped in with the combs so that no further water need be put in. Next, place the wooden cover in position over the can. These will warp somewhat with the steam; but they can be reversed occasionally in order to make a good fit. These covers are used to keep away the cold air and thus prevent the wax from chilling. Keep turning the screw down slowly until it has reached the limit. This should take about two minutes. Then raise the screw about two inches, and with a piece of bent wire pull up on the rope handle of the wooden plunger until it floats to the top, so that the hot water may again saturate the contents of the burlap. In about one minute apply the pressure again slowly, until the limit has again been reached. Then release the pressure as before, and after this turn the screw down again for the last time. This whole process of pressing will take about ten minutes in all. While the pressure is still on the comb, remove the wooden covers from the can, and tip up the press as shown in Fig. 16, so that the water and wax may run out into a small tub or large pail on the floor under it. Leave the press turned over for a few moments until all of the water and wax drain out, and then tip it back to its regular position. An old sack or piece of carpet should be thrown across the top of the small tub to keep the wax from chilling until it is emptied into the large can, as explained later.

The screw should now be raised, the follower lifted out, and the burlap shaken into a box near by. If the piece of burlap is rubbed quickly with the hands, most of the refuse can be shaken out. Now place this burlap over the press-can again, and repeat the process with another gallon of comb just as soon as possible. There should be no time wasted between the one pressing and another, for the can, follower, etc., are liable to become cold.

When the screw is turned down the first time on the next batch of melted combs, empty the hot water and wax in the shallow tub into the large can near by ready for it. For convenience this can should have a faucet or gate at the bottom so that hot water may be drawn off when it gets too full, the hot water to be used over again in the next boiler of comb. It does not matter even if it is quite black and thick, for experience has shown that this dark-colored water does not discolor the wax. A piece of carpet should be kept over the top of this large can in order that the wax may not become chilled. At the end of the

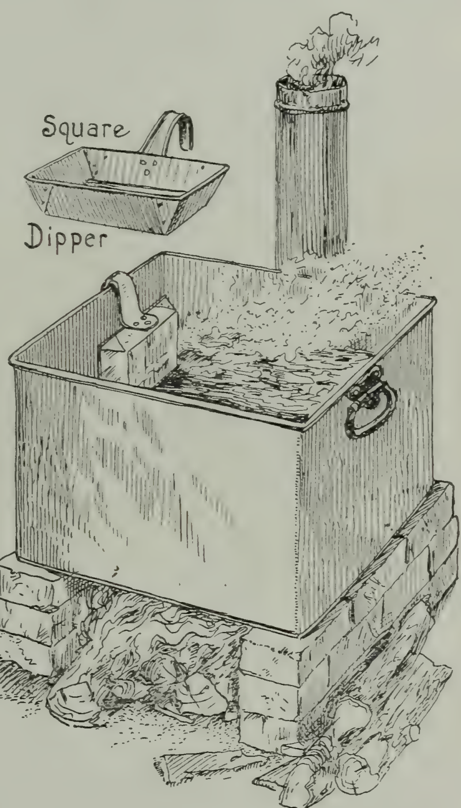


Fig. 17.—Hatch's outdoor furnace for melting comb.

day, or whenever the work is over, the hot water may be drawn out until just before the wax begins to come. The wax may then be run out into suitable molds, which, if made of metal, should be well moistened on the inside with soapsuds to prevent the wax from sticking.

The refuse from the press, which has been shaken out in a large box, *is not yet free from wax,* and this point should be plainly understood. We have found that one treatment as above described will remove only 90 per cent of the total amount

of wax. The refuse will look perfectly clean and dry, and many will be deceived and throw it away, thinking it not worth a second melting; but from quite a good many samples that we have tested from different lots of refuse that have been sent in from other producers, we are very sure that there is a waste of from eight to ten per cent of the wax unless this refuse is run through the press again. For this reason, when a sufficient amount is accumulated it is well to put it back in one of the boilers and boil it again in water. The second treatment will take a little over half the time the first did, since rather more can be pressed at a time; but the average beekeeper can well afford to do it. Wax from very old combs can be extracted in this unheated press, even though it is gone over twice, at the rate of about seven or eight pounds an hour, and the final waste need not be over three per cent.

An important fact that must not be overlooked is that the quality of wax from this press is the very best. The cakes need only a little scraping on the bottom, to be ready for market. The color is good, so that there is no need of refining the wax afterward. If the combs were melted up without water, however, the wax would very probably be discolored from too high a temperature.

The above plan sounds somewhat complicated, but it is been found to be no more so than most methods of rendering wax. Of course it is not possible to do work of this kind without making some muss, and it is always a good deal better if the work can be done in a basement or in a shed where it does not make so much difference if a little wax is spilled. If the work is done in a kitchen, the floor should be well covered with newspapers, which can afterward be taken up and burned. When boiling comb in a boiler great care should be exercised to prevent the wax from boiling over on the stove and possibly causing a fire.

When infected combs are rendered, every precaution should be taken to prevent bees from robbing. If the building can not be made bee-tight, the work should be done at night, and every tool and utensil used should be thoroughly scalded again before daylight. The refuse from infected combs should be burned or buried immediately, and the water that was used should be poured where the bees can not possibly get access to it.

HOW TO RENDER WAX WITH HOME-MADE APPLIANCES.

If one wishes to construct a good wax-press with as little trouble as possible he had better follow quite closely the design shown in Fig. 19. There are many things that must be taken into consideration in designing a wax-press; and we know that the one shown will be satisfactory, although, of course, it will not be quite so convenient as one made where the proper castings, etc., can be obtained.

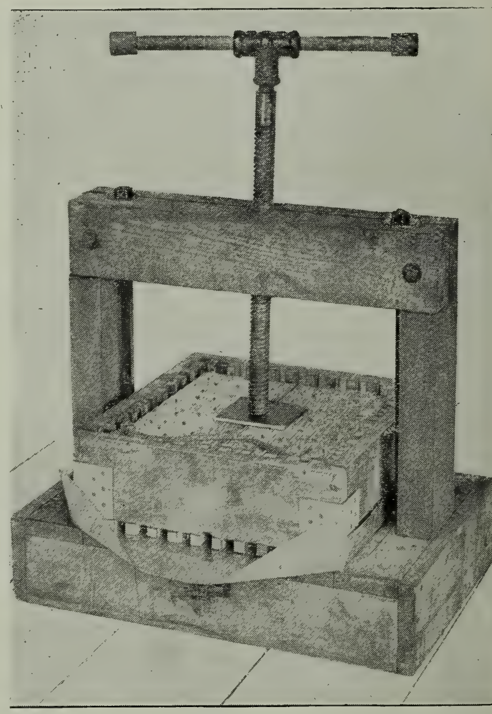


Fig. 19.—A good design for a home-made unheated press.

A bench-vise screw will answer the purpose if the thread is not too coarse. Two half-inch rods threaded on each end hold the framework rigid; but it is advisable to use very large washers under the nuts, as the strain tends to sink small washers into the wood, even if oak is used. Thick iron plates with half-inch holes drilled in the centers would answer the purpose better than washers.

In making a press be very careful to see that every part is perfectly square and

plumb; for if the screw is not absolutely vertical it is almost impossible to succeed. The secret of doing good work is to manage so that the cheese shall be the same thickness all the way through; and if the screw is not perpendicular to the platform it is impossible to do this.

In a home-made press, since it is hardly practicable to construct any thing without too much expense that will keep the follower always at right angles with the screw, it is necessary to place the old comb evenly in the box so that the follower shall go down as straight as possible. In the illustration the screw rests on top of a thick iron plate on the follower to keep it from entering the wood.

Fig. 20 shows more clearly the construction of the pressing-box and the tin tray under it.

A solid wooden bottom might be made for the box, but the wax and hot water would leak through it too much, and so it is better to have nothing but cleats and allow both wax and hot water to run directly through them on to the tin tray and then out at the opening in front. The front piece of the box should be about half an inch narrower than the other sides, in order to give an opening for the wax to escape. The corners of the tin tray do not need to be soldered.

A press somewhat similar to this has been used with good satisfaction by Mr. E. D. Townsend, of Remus, Michigan. It will be noted that, in the old original Hatch-Gemmill press, Fig. 9, a tin tray is also used in connection with the wooden pressing-box; in fact, this home-made press is very similar to that one, except that it is simpler, stronger, and easier to construct.

It must be borne in mind that, since there is no way to fill the pressing-box with boiling hot water and allow it to remain full until thoroughly heated, when starting work, boiling water must be poured over the box and contents until they are thoroughly heated; and then if the work is continuous the parts will not become cold enough to chill the wax.

A plain square box would burst if the corners were not strengthened, hence it is necessary to bind them by nailing on pieces of very heavy tin or galvanized iron as shown. Thus reinforced the box is amply strong.

SCREW PRESSURE VS. LEVER.

A long heavy lever may be preferred in place of a screw, and in some places it may be easier to construct and operate. The same plan can be followed as that shown in Fig. 6. It is very necessary to guide the lever in some way in order to keep the pressure always vertically above the center of the pressing-box. It is much more difficult to handle a lever than a screw, for there is so much weight to

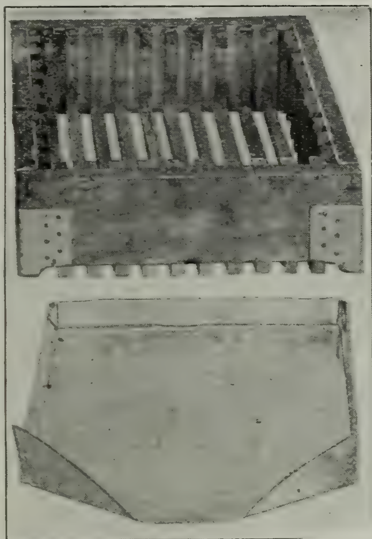


Fig. 20.—Pressing-box and tin tray of the home-made press.

manage. The argument is often advanced that the lever is preferable for the reason that the operator can leave it alone, knowing that the pressure will be applied constantly if heavy weights are hung on the end. While this point is valuable in connection with pressing combs submerged in boiling water, as shown in Fig. 6, it is of little advantage in the unheated press; for left even a few minutes the wax would chill and the press become cold. Quite thorough work with the unheated press is possible if rapidly done; but if the combs are left they soon cool off, so that it is necessary to heat thoroughly everything with boiling water before going on.

If a lever is used, a very heavy construction is necessary unless one end is securely anchored to a stump. It is seldom that a wall or floor in a building can be found heavy enough to withstand the pressure of a 12-foot lever without giving way. In

most places, therefore, a screw is much more convenient and easier to manage.

WHICH IS THE BEST METHOD TO RENDER WAX?

The answer to this question depends entirely upon circumstances. If cappings or new comb are to be rendered, and there is no particular need of doing rapid work, a solar extractor is the best by all means, as it works for nothing and boards itself. For rendering large quantities of cappings or new comb we think the unheated press is the best one to use, as the bulk of the wax can be simply dipped off the top of the hot water into molds to harden, leaving only a comparatively small amount of refuse to be run through the press.

For general rendering of old combs we believe the unheated press to be the most practical for the average beekeeper. It is not possible to do quite as thorough work with this press, but the relatively small amount of loss of from two to three per cent of the total amount of wax would not warrant the average beekeeper in going to the expense of purchasing or making a large hot-water press. It is our opinion that the producer who makes less than 300 pounds of wax per year can do no better than to follow the plan here described, using the unheated press. Some may want to know why a very small hot-water press would not be the best for the small beekeeper; but we have never found such economical, if the time and fuel required are taken into consideration.

For the larger producer who makes more than 300 pounds of wax a year we believe a good-sized hot-water press is a real necessity. By having the capacity very large, a large amount of wax can be produced in a day, leaving less than one per cent of the wax in the refuse.*

THE AMOUNT OF WAX IN COMBS.

We are often asked how much wax can be rendered from comb holding a given amount of honey; but it is quite difficult to answer such questions, as it makes considerable difference whether full sheets of foundation were used, and also whether such foundation was thick or thin. In general, however, we might say that it requires about 4 lbs. of wax in comb to hold 100 lbs. of honey,* or, in other words, that a pound of new comb will hold about 25 lbs. of honey.

A sixteen-ounce section of honey consists approximately of 14½ ounces of honey—a little over one-half ounce of wax and about one ounce of wood. Fig. 21 shows the results after separating the honey, wax, and wood, in a sixteen-ounce

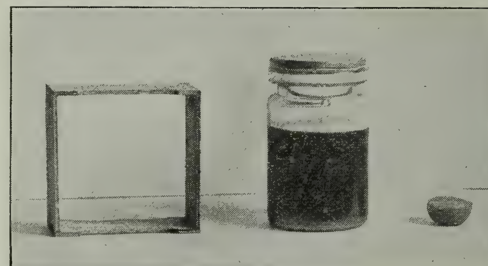


Fig. 21.—Honey pressed from a section; result—over 14 ounces honey, ½ ounce wax, and 1 ounce of wood.

section. Of course, these results, as before mentioned, are not always the same, and the different amounts vary considerably.

On one occasion we melted over 600 lbs. of candied comb honey. Keeping careful account of the weights, we found that the percentages of honey, wax, and wood were approximately 88, 5, and 7, respectively.

HOW TO REFINE WAX WITH SULPHURIC ACID.

Wax cakes, as they are bought up, are usually of all grades and colors. The difference in color is due largely to the amount of impurities the wax contains. In all the years that we have been in the business we have found no practical or satisfactory way of bringing the wax to a yellow color—that is, to its original state of purity, except by treating it with acid.

The method, in brief, is as follows: Fill a wooden tank or barrel a quarter full of water, and add cakes of wax until nearly full. The water is then boiled until all the wax is melted, when a quantity of commercial sulphuric acid is poured in, and the boiling continued until all is thoroughly mixed. The heat is then removed and the impurities allowed to settle.

* You have not given another of my babies, the dripping-pan wax-extractor, "Fifty Years Among the Bees," page 323. It does the same work as a solar, but may be used in cold weather, and, moreover, may be preferred by one having very few bees, as one costing less.—C. C. M.

* One hundred pounds of chunk honey built without foundation will yield almost exactly three pounds (avoirdupois) of wax.—A. C. M.

For a detailed account, it may be well to describe our own system of refining wax. Our tank is a little over 3½ feet in diameter, and about 5 feet high. Water is run into it to a depth of 12 inches, and then 1500 lbs. of wax is thrown in, making it about full. The mass is then heated by means of a jet of steam from a pipe projecting down into the water from the top. When all the wax is melted, the acid is poured in. Dark wax to make brood foundation requires three pints of acid; but if light enough for surplus foundation, not more than 1½ pints is used. If the wax is already of good quality, so small an amount as one pint of acid will answer. On the average, therefore, we use one quart of acid in 80 gallons of water for 1500 lbs. of wax. Soon after this is poured in, the color of the boiling wax will be seen to grow lighter, and, after a minute or so, the boiling is stopped.

The steam-pipe is now drawn out, the tank covered with a cloth or carpet, and allowed to stand as long as the wax will remain liquid, or about 24 hours. At the expiration of this time the water and acid will have settled to the bottom by reason of their greater specific gravity; and the consequence is, that the wax itself, after being purified, is allowed to become thoroughly cleansed of any residue of acid, and the dirt accumulation will have settled beneath the wax into the water. The melted wax is now drawn off from the top, and poured into any sort of receptacles with flaring sides. When the wax is nearly all removed or shows evidence of coming near the dirt, the rest is allowed to stand. As soon as it cakes in the tank it is lifted out, and the dirt clinging to the bottom scraped off.

We do not recommend the use of acid for refining wax on a small scale, for, without proper receptacles and facilities for heating, the wax is more often injured than benefited.

BLEACHING BEESWAX.

There are methods by which beeswax can be bleached by the use of chemicals; but after some experimenting we have not been successful with any of them, and finally discovered that, for the economic uses of the beekeeper, foundation made of bleached wax was no better than, if as good as, that having the natural yellow color, refined by the use of sulphuric acid as explained elsewhere. Yellow wax is more ductile, and therefore more easily worked by the bees; and even when used for section honey-boxes, the combs from yellow wax are about as white as those from the bleached; so that when capped over no one can tell the difference. But very often dealers have a call for bleached beeswax; and the only practical way of getting it is to convert the product into thin sheets or small particles, and then subject them to the sun's rays for a suitable length of time. When sufficiently bleached it may be melted up and caked.

HOW TO DETECT ADULTERATED WAX.

We have already mentioned the fact that beeswax is liable to adulteration with paraffine or ceresin, and sometimes with ordinary grease or fat. Some unscrupulous box-hive beekeepers, after brimstoning their old "skeps," and melting up the wax,* add just enough tallow to increase the weight, because grease is cheap compared with the ordinary product of the hive. But such adulterations are very easily detected, both by smell and sight. The cakes have a greasy smell and feeling; and when subjected to the float test, presently described, they will immediately rise to the top of the liquid. Paraffine and ceresin adulterations are not so easily recognized; but nearly all pure beeswax, when chewed for a few minutes, will crumble in fine particles, while wax containing a small percentage of paraffine or ceresin will chew like sealing-wax and ordinary chewing-gum.

The simplest and most reliable test is the float or specific-gravity test. We have already stated that the specific gravity of our ordinary commercial paraffines and ceresins is below that of beeswax. As an ordinary article of pure beeswax is lighter than water (wax standing 965 and water at 1000), of course it will float when put into that liquid. Into a jar partly filled with water pour alcohol until a small piece of beeswax of known purity settles to the bottom, taking care not to pour in too much alcohol, for we want the wax to sink just to the bottom; that is, we desire the

* See Box Hives and Straw Skeps.

alcoholic liquid and the wax to be of the same specific gravity. Now, then, if we put in a piece of adulterated beeswax containing, say, 50 per cent of paraffine or ceresin, it will float on the surface of the liquid. Next take another piece of wax that contains only 10 per cent of adulteration. It still floats, but has a tendency to sink almost under the surface. If we take another piece containing only 5 per cent, it may float or gradually settle to the bottom of the jar, perhaps standing upon a single point.

For all practical purposes we have found this float test to be entirely reliable; that is, it has so far shown us unerringly every adulterated sample. We remember particularly one instance where quite a large shipment of beeswax was sent us. It was very beautiful, and the cakes were all of a uniform size; but the price was very low. It was suspicious, and accordingly we subjected it to the float test. Sure enough, a small piece of the wax stayed nicely on top of the test liquid without the least effort. We then put it into a liquid that would let a 25 per cent ceresin adulteration sink. After hovering near the surface it gradually sank, and behaved like the piece of wax that we knew contained 25 per cent of ceresin. We wrote to the shipper that we did not want adulterated wax; that we *must* have the pure article; that he would have to take the stuff off our hands. He did it very promptly, without even trying to defend himself, any more than to say that he thought we were not very particular. He knew better, but thought he could unload the stuff on us without our being any the wiser.

CLEANING WAX FROM UTENSILS.

Perhaps the readiest means is to immerse them in boiling water until all the wax is thoroughly melted off, then drain, while hot. They can then be wiped off with soft newspaper. Where the article can not be easily immersed, benzine or a solution of sal-soda will readily dissolve the wax so it can be cleaned off with a cloth. Benzine* dissolves wax almost as readily as water dissolves sugar.

Caution in handling wax.—We have spoken about order, care, and cleanliness, in handling honey, candy, etc.; now, friends, it is a much more serious thing to daub melted wax about the house, on the carpets and on your clothes, than it is to daub either honey or candy. You can very easily spoil a dollar's worth of clothing while fussing with ten cents' worth of wax, as we know by experience. When you commence, bear this in mind, and resolve that you are going to have things clean and neat at every step, no matter what the cost. Newspapers are very cheap, and it takes but a minute to spread them all around the room where wax may be dropped.

* Kerosene does nearly as well, and is much safer for the average individual.—A. C. M.

WAX WORMS.—See Bee Moth.

WEIGHT OF BEES.—Some very interesting experiments were conducted by Prof. B. F. Koons, of the Agricultural College, Storrs, Ct., to determine the weight of bees and the amount of honey they can carry. The results of these experiments were given in *Gleanings in Bee Culture;* and the article is so valuable we have thought best to preserve it in permanent form:

Some two years ago, in a leisure hour I went to my apiary and captured one outgoing bee from every hive and subjected them to the fumes of cyanide of potassium for a few moments to render them inactive, and then weighed each bee upon our chemical balances—a pair of scales so delicately adjusted that it is an easy matter to weigh the one-millionth part of a pound or the one-thousandth part of a bee. From the weight of each separate bee it was a very simple problem in arithmetic to compute the number of bees in a pound. The results showed that mine, which perhaps are a fair average in size and weight, ran from 4141 to 5669 in a pound. These results you published in *Gleanings,* and there expressed a wish that I would also determine the amount of honey carried by a homing bee. In my research for the weight of bees I took those just leaving the hive, which naturally would represent the normal weight, without extra honey or pollen.

During the present summer (when the bees were very active) I have undertaken to carry out your request as to the amount of honey carried by a bee. My method was this: From the chemical laboratory I secured a couple of delicate glass flasks with corks, marking them A and B. Each was very carefully weighed, and the weight recorded. I then went to a hive, and, with the aid of a pair of delicate pliers, or pincers, I captured a number of incoming bees and dropped then into flask A. I then secured about an equal number of outgoing bees in flask B. These were then taken to the laboratory immediately, and each flask again weighed, after which the bees were carefully counted and released. This operation was repeated quite a number of times, not on the same day, but as opportunity offered, and when the bees were bringing in an abundance of honey. I captured from 20 to 45 bees for each flask at each trip, aiming to have, as nearly as might be, the same number in each flask

on any particular trip. I always weighed the flasks before starting out, lest some little bit of soil or stain, or even moisture on the glass, would render the results less accurate; I also always allowed any moisture condensed upon the inside of the flasks, while the bees were confined, to evaporate before weighing for another trip. I then treated my results as follows: From the weight of flask and bees I deducted the weight of the flask; the remainder I divided by the number of bees confined on that trip. This gave me the average weight of the bees captured at that time. The average weight of the bees in flask A, or loaded bees, was always greater, as it should be, than the average weight of the bees in flask B, or unloaded bees. The difference between these two weights gave me the average amount of honey carried by that lot of bees.

Mine are Italian and hybrid bees, but I made no attempt to determine the difference in the amount carried by the different swarms or breeds. I kept no record of the swarms except that I guarded against going to the same hive for a second lot of bees. A considerable difference does appear, but probably that arises in part from the abundance or scarcity of honey on any particular day when the colony was visited. My aim was to secure reliable results, as nearly as possible representing the average amount of honey carried by bees.

The following is the result of weighing several hundred each, of returning and outgoing bees. The smallest number of bees necessary to carry one pound of honey, as shown by my results, is 10,154; or, in other words, one bee can carry the 1-10154 (one ten thousand one hundred and fifty-fourth) part of a pound of honey; and the largest number, as shown by the results, required to carry a pound is 45,642; and the average of all the sets weighed is 20,167. Perhaps, then, it is approximately correct to say that the average load of a bee is 1-20,000 (one twenty-thousandth) of a pound; or, in other words, if a colony has 20,000 bees in it, and each one makes one trip a day, they will add the pound to their stores. Of course, not all the bees in a colony leave the hive, the nurses remaining at home, hence necessitating more trips of those which do "go a field."

I also repeated my observations of two years ago on the weight of bees, and found that my numbers ran from 3680 to 5495 in a pound, and the average about 4800, the same as in my former test. I likewise secured the following on the weight of drones: Of a dozen or more weighed, the largest would require 1808 to make a pound and the smallest 2122, or an average of about 2000 drones in a pound, over against nearly 5000 workers.

B. F. Koons.

Agricultural College, Storrs, Ct., Sept. 3, 1895.

In a nutshell, and speaking in round numbers, we may say that it takes 4800 bees to make a pound; and that, while 10,000 bees may carry a pound of nectar, twice that number, or 20,000, is probably more nearly the average. During basswood bloom, the first figure should be considered as the nearer correct one because the bees drop down at the entrance; but from almost all other sources of nectar the twenty-thousand mark is the one to accept.

Let us now look at these interesting figures in another way: A bee *can* carry half its weight in nectar; and perhaps, under certain circumstances, a trifle more; but, generally speaking, one-fourth its weight is the amount. A single strong colony has been known to bring in a trifle over 20 lbs. of nectar from basswood in one day;* but usually four or five pounds is considered a *remarkably big* day's work. (See Scale Hive.) If we figure that there were, say, in the first instance (20 lbs. per day), 8 lbs. of bees, there would be 38,400 bees. If 20,000 of these were field bees (estimating 10,000 necessary to carry a single pound of basswood nectar), those bees must have made forty trips. On the same basis of calculation, a colony of equal strength that brought in 5 lbs. would make one-fourth as many trips, or an even ten. This would leave for each trip one hour for ten hours; or, in the case of 20 lbs. a day, twenty minutes.

Both Profs. Gillette and Lazenby, the former of the Colorado Experiment Station and the latter of the Ohio State University, conducted a series of experiments which closely approximate figures of Prof. Koons, so we are sure they are correct.

WEAK COLONIES, TO STRENGTHEN.—See Uniting, sub-head Alexander Plan*;* also Nucleus.

WHITE HOLLY.—See Gallberry.

WHITEWOOD (*Liriodendron tulipifera*). This is often called the tulip-tree, we suppose from its tulip-shaped flowers. Other vernacular names are white poplar and whitewood; a handsome stately tree, sometimes exceeding 150 feet in height, growing chiefly in the forests of the southern States, but extending northward to Michigan. The large greenish-yellow flowers are bell-shaped. The tulip-tree is very common over all Georgia. It blooms in April, and secretes a very bountiful and reliable supply of nectar. The honey is dark and thick, and, when pure, is of inferior quality, but it nearly always improves by an admixture of either blackberry or holly honey or both.

After wrtiing the foregoing, we concluded we did not know very much about the whitewood, especially the blossoms. So we traveled off into the woods, where we found a tree; but there were only buds to be seen,

* We had one colony that brought in over 43 lbs. in three days; and Doolittle 66 lbs. in the same time from basswood.

season; but hark! whence come those sounds of humming-birds and humming bees? Whence, too, that rare and exquisite perfume? We looked higher, and, away in the misty top of the tree discerned, by the light of the setting sun, multitudes of bees flitting about. Oh that we were just up there! We looked at the rough trunk of the tree, and meditated that we were a boy no longer, but forty years of age, or would be in a few months more. We might get up to that first limb; after a good deal of kicking and puffing, we did. The next was a harder pull yet; but soon the limbs were thicker, and finally we began to crawl upward with about as much ease as our year-and-a-half-old baby goes upstairs whenever she can elude maternal vigilance. Up, up, we went, until, on looking down, we really began to wonder what that blue-eyed baby and her mamma would do should our clumsy boots slip, or a dead limb break unexpectedly. Now we were at the very summit of the tree, and, oh what a wonderful beauty we saw in those tulip-shaped blossoms that peeped from the glossy-green foliage all about us! No wonder there was humming. Bumble-bees, gaudy-colored wasps, yellow Italians, and last, but not least, beautifully plumaged humming-birds, were all rejoicing in a feast of sweets. Every now and then one of the latter paused before our very face, and, as it swung pendulously in mid air, winked its bright little eyes, as much as to say, "Why, what on earth can *you* be doing away up here in our domain?"

We picked off the great orange-colored, mottled blossoms, and looked for the honey. We presume it was the wrong time of day to expect much; but inside, those large petals seemed to be distilling a kind of dark dew that the birds and insects were licking off. It tasted to us more like molasses than honey. In the cut our engraver has tried to show you what we saw in the tree-top.

As the sun had gone down, we commenced in a rather undignified way to follow suit, and after resting a little limped home. Although stiff and sore, we carried an armful of whitewood blossoms to surprise the good folks who, probably, had never dreamed of the beauties to be seen only in the tree-tops.

Leaf, bud, and blossom of the whitewood or tulip-tree.

Our friends in the South have a great deal to say about what they call "poplar honey;" and, if we are correct, the poplar is the same tree which we call whitewood. It blossoms with them in April and May. We know what time it blossoms here, for we thought about its being the 27th of May, when sliding down out of that tree. Shortly after, we received some bees from G. W. Gates, of Bartlett, Tenn. The combs were filled, even bulged out with a dark honey, such as we have described, and the bees had built fins of snow-white comb on the cover of their shipping box. From this we infer the honey must be yielded in great abundance in those localities. We have

not blossoms. It must be too early in the seen it stated that the large flowers sometimes yield a spoonful of honey each. As the tree is often used for ornament, we make the following extract from *Fuller's Forest-Tree Culturist:*

LIRIODENDRON TULIPIFERA (*Tulip-tree, whitewood*). Leaves smooth, on slender petioles, partially three-lobed, the middle one appearing as though cut off; flowers about two inches broad, bell-shaped, greenish yellow, marked with orange; seeds winged, in a large cone-shape cluster which falls apart in autumn. The figure shows a single seed as it appears when separated from the mass. It blooms in May and June, and the seeds ripen in late summer or early autumn, and should be sown as soon as ripe, in good, moderately dry soil. They may remain in the seed-bed two years if desirable, but should receive a slight protection the first winter; tree of large size, sometimes 130 feet high, with a very straight stem; wood light color, greenish white, soft and light, not hard enough to receive a polish. It is much used in cabinet work, and for making panels for carriages, and for any inside work where toughness or a hard surface is not required. There is perhaps no native wood that will shrink more in seasoning than whitewood, for it not only shrinks sidewise but endwise as well; yet when once thoroughly seasoned it remains fixed, and does not warp or twist like many of the hard and tough kinds of wood. There is also much difference in the character of the wood coming from different sections of the country, and mechanics who are conversant with the various kinds and localities will readily tell whether specimens came from the West or East. The latter is of a light greenish color, grain not so smooth and soft, and sometimes rather tough. The wood is but little used, except for the purposes mentioned above, and consequently it is only large trees that are of much value. It is one of the most beautiful ornamental trees we possess, growing in a conical form, and producing an abundance of beautiful tulip-shaped flowers in spring. The roots are soft and sponge-like, and it requires great care in removing to insure success.

The question is often asked, "Is whitewood good for bee-hives?" It may do for sections and brood-frames, but it is very unsatisfactory for hives, for the reasons given in this extract.

WILD CHERRY (*Prunus serotina*), known locally as black cherry. Few trees of Florida are more stately and more symmetrical in their growth than the wild cherry. It is native all over Florida, on high pine lands and in low hammocks. The wood is a beautiful red, with a fine grain, and is very valuable for cabinet purposes. The wood is, however, somewhat softer than that of the wild cherry of the North (*Prunus Pennsylvanica*). In appearance it closely resembles the wild cherry of more northern latitudes. It seldom fails to yield honey, and bountifully too. Coming as it does just before the orange trees bloom, it gives a final spurt to brood-rearing that is valuable indeed. As a surplus honey it is more of a pest than a benefit, as the honey is dark red, and as bitter as wormwood. The flavor of a cherry pit is about that of this honey. It does not take a great deal of it to spoil the flavor and color of the first orange honey of the season, and many beemen in orange sections must extract their supers of all traces of wild-cherry honey or have their fancy orange honey touched and tinged. In the vicinity of DeLand, Fla., it is a real nuisance after the orange honey commences to come in. Up to that time it is a bonanza and a blessing to the apiarist. The writer has in many cases placed a half-depth super on the strong colonies when they were storing from wild cherry, which was removed when the wild cherry was over and orange began. Then he would extract the supers and put back on the hives for the flow of orange honey.

WILD SUNFLOWER.—This is the name rather loosely applied by beemen of Florida to various species of *Carduaceae*, or thistle family, that grow over the southern half of the peninsula. From specimens sent in as "wild sunflower" it appears that there are included, under the term, *Gaillardia lanceolata, Helianthella, Coreopsis,* and burr-marigold. The honey-yielding qualities of the wild sunflower are marked and valuable wherever it grows. Blooming from Sept. 15 to Oct. 15, its period of bloom is long enough to change an otherwise poor season into a fair season, and is always fine for putting colonies in fine shape for the close of the year, the dull season in apiculture, even in Florida. In the vicinity of Stewart and Osprey, Fla., one on the east, the other on the west coast, and south of a line drawn between the two, may be seen thousands of acres of these beautiful golden plants, resembling the Spanish needle and *Chrusopsis* of the North. It is found further north than Tampa, of course, even as far as Osceola, in noticeable quantities; but beemen of the southern third of the State are most enthusiastic over it. The region about the edges of the Everglades, the "savannahs," seems to be its best habitat. Certain species seem most at home on the saw-grass lands, or just outside of them, where the water lies but a slight dis-

tance below the surface. Other species seem to flourish best in pine-wood sections, where there is some swampy tendency in the soil. It does not seem to be at home on real high pine land. Rather unreliable in its yield, it secretes nectar only during very dry falls. A fair crop can be counted on about every two or three years; a "bumper" about once in five years. The honey is amber, fairly good body and rather mild, but is, after all, a "fall flower" crop, and so not ranking among the *best* honeys by any means.

WILLOW (*Salix*).—This is a very natural or clearly defined genus of shrubs and trees found chiefly in the north temperate and arctic zones. Of the 161 described species, about 78 occur in North America, more than 30 of which are in eastern America. So variable are the species, and so freely do they hybridize, that

Pussy willow in seed.

any entirely satisfactory treatment from a systematic standpoint is impossible. The Swedish botanist Anderson, whose monograph, published in the Prodromus of De Candolle, was the work of nearly twenty-five years, declared that he never saw two specimens of *Salix nigricans,* which has one hundred and twenty synonyms, that were exactly alike. In Great Britain the number of species of willow has been placed all the way from twelve to eighty.

The very small flowers are naked, or devoid of both sepals and petals, and are crowded together on an elongated stem or axis forming a cluster called an ament or catkin. The stamens and pistils in all species are in separate flowers, which are borne on different individual plants, some producing only staminate flowers, others only pistillate ones. In a staminate ament of the pussy willow (*S. discolor*) the writer has actually counted 270 flowers, and in a pistillate ament 142 flowers. The multitude of bright-yellow anthers render the staminate blossoms very conspicuous. As an evi-

Golden willow.

dence of their attractiveness, it may be mentioned that they are used in England for decorating the churches on Palm Sunday, and are offered for sale in New England cities by street flower-venders. The flowers are formed the preceding season, and appear in early spring before or with the leaves.

All of our species furnish both pollen and nectar, but it would, of course, be useless to look for pollen on pistillate shrubs or trees. The nectar is freely secreted in both kinds of flowers on the tips of minute flat glands, which in the pistillate flowers may be found at the base of the ovary. As our early willows attract great numbers of insects, the supply of nectar may be temporarily exhausted; but it should not be concluded, therefore, that it is wholly absent. If a branch of flowers be broken off and carried into the house and placed in water, and the nectaries examined after twenty-four hours under a microscope, nectar will probably be found in abundance.

The earliest willow to blossom in New England is the glaucous or pussy willow (*Salix discolor* Muhl.). On a calm warm

day the sweet odor may be detected several rods away, and a swarm of insects may be seen hovering about the bright yellow sprays of bloom. Besides honeybees there are female bumblebees, the only form of bumblebee then on the wing, and great numbers of wild bees belonging to the genus *Andrena* gathering pollen for brood-rearing. Several species of these bees are never found on any other flowers than the willows. Then there are many flies and a few butterflies and beetles. Ants often climb the stems and rob the flowers of the nectar, which is quite plentiful. In England some willows are said to be visited by moths in the evening.

The early-blooming willows are visited by large numbers of honeybees, both for pollen and nectar, and are of great value to the beekeeper. One of the commonest willows in the Eastern States is the pussy willow, which is a large shrub growing on river banks. In Massachusetts it blooms along the last of March and early in April. In Georgia the black willow (*S. nigra* Marsh) grows along streams throughout the State. It blooms in March, and in a few localities yields a surplus of honey of medium quality. The black willow is also common in Texas, where it is valued both for pollen and honey. Other willows which are common in the eastern States are *S. sericea* Marsh (silky willow); *S. rostrata* Richards, and *S. cordata* Muhl. In California, Richter says, the willows yield a surplus in several counties. It is a dark-amber, bitter honey.

Among the willows introduced from Europe, and cultivated, are the osier willow (*S. viminalis* L.); the Kilmarnock willow (*S. caprea* L.); the white willow (*S. alba* L.), of which there is a variety with yellow twigs called *vitellina,* and the weeping willow (*S. babylonica* L.).

A honey-flow from the willows at Borodino, N. Y., is described by G. M. Doolittle as follows:

We have three kinds of willows—the golden, the white, and the weeping willow, which are of much value as honey-producers in the order named. When these willows are in bloom, and the weather warm, the bees rush out of their hives at early dawn, and work on the flowers all day long as eagerly as they do on clover or basswood. The blossoms often secrete nectar so profusely that it can be seen glistening in the morning by holding the blossoms between you and the sun, while the trees resound with that dull busy hum from morning till night, so often heard when bees are getting honey. As this is the very first honey of the season, I consider it of the greatest value to the bees, for brood is now crowded forward with great "vim," giving us the bees which work on white clover, while the honey often very greatly helps the depleted stores of the hive.

From the few trees along a small creek near here, my bees frequently make a gain of from six to ten pounds of honey while the willows are in bloom, and one season they made a gain of fifteen pounds. This spring some of my best colonies gained eight pounds, while on apple bloom they did not get more than a living from apple orchards white with bloom all about. The honey from the willow is quite similar to that from the apple bloom, and has a nice aromatic flavor. As the willows give the first pollen, and also the first honey each season, it will be seen what a great help they are to all who have them in profusion near their bees. The only drawback is the weather often being unfavorable, for I do not think that more than one year in three gives good weather all through the time willows are in blossom. As it is often too cold, rainy, cloudy, or windy for the bees to get to the trees at this season of the year, honey and pollen from this source are not at all certain.

WILLOW-HERB (*Epilobium angustifolium* L.); often called fireweed, sometimes Indian pink and rose bay. Occurs in the northern part of Europe, Asia, and North America; in eastern America it extends southward along the Appalachian Chain to North Carolina, and in the West it follows down the Rocky Mountains to California. Its growth is confined, however, largely to the lumbering regions of northern Wisconsin, Minnesota, Michigan, Canada, Washington, and Maine,* upon areas that have been burned over; hence the name, "fireweed." After forest fires it seems to spring up spontaneously, monopolizing the soil itself. Sometimes it grows in localities never so devastated.

It is a handsome plant, usually only a single stalk growing from two to six feet high. The flowers are dark pink, arranged in clusters around the stalk. As the season advances, the first bloom goes to seed; and as the stalk extends upward, more blossoms appear, so the plant keeps in bloom from July till frost. Thus appear on each stalk buds, blossoms, and seed-pods at the same time.

Willow-herb, or fireweed, yields quantities of white honey. Some of it is so light-colored as to be actually as clear and limpid as water, having flavor simply superb —at least so we thought after eating some at one of the Michigan conventions which we attended at Grand Rapids. Mr. Hutchinson styles it the whitest and sweetest hon-

* Not confined to districts specified. Introduced to this country from Europe and Asia.—A. C. M.

The willow-herb of northern Michigan.—No. 1, the blossom; No. 2, the plant; Nos. 3 and 4, its habitat.

ey he ever tasted, and says the flavor, while not very pronounced, is suggestive of spice. The quality of the honey, its unfailing supply from year to year, following right after clover and basswood, and blooming from then till frost, make it one of the most valuable honey-plants known. Unfortunately its growth is confined almost exclusively to the regions where forest fires occur. But beekeepers situated in its vicinity are enabled to secure immense crops of fine white honey. Another remarkable feature of the plant is, it yields every year—at least so continuously that a failure has scarcely been known, even by the oldest inhabitants in the vicinity where it grows.

Mr. Hutchinson estimates there are thousands of acres in northern Michigan where this plant grows, without bees to gather its delicious nectar. But this condition certainly can not long exist; for where one can produce anywhere from 100 to 125 pounds of comb honey per colony, unoccupied fields will soon be covered by beekeepers, after the manner of the rush of the gold-seekers to the Klondike.

In the background will be seen the straight black shafts of dead pine-trees that stand out alone as the only survivals of their class from the fires. While we can not but deplore the loss of the pines that furnish the only timber fit to make hives, we rejoice that they have been succeeded by so valuable a honey-plant as the willow-herb.

Outdoor wintering at the apiary of F. J. Miller, of London, Ontario, Canada.

WINTERING.—Whoever has gone over faithfully the preceding pages is now nearly ready to sum up the matter of wintering. Under the head of ABSCONDING SWARMS, in the opening of the book, and under the subject of UNITING, he has been cautioned against dividing, and trying to winter weak colonies. See "Absconding in Early Spring," under the head mentioned. In regard to keeping bees warm through the winter with ARTIFICIAL HEAT, see that head. Concerning the effects of different kinds of food or stores on the welfare of bees during winter, see DYSENTERY, SPRING MANAGEMENT, FEEDING AND FEEDERS, CANDY FOR BEES, and SPRING DWINDLING. On the subject of fixing the size of the entrances see ENTRANCES TO HIVES, VENTILATION, and SWARMING. Some very important information is given under ENTRANCES;

and it would be advisable to re-read that article before one takes up the matter further here. For management of bees in the spring, see SPRING MANAGEMENT, DYSENTERY, and SPRING DWINDLING. For a consideration of the different sizes and shapes of frames for wintering, see HIVES. For the discussion of double-walled or chaff hives, see HIVES. For stimulation in the spring, see FEEDING. For the consideration of windbreaks, see "Windbreaks," under APIARY. For the effect of honey-dew on wintering, see HONEY-DEW.

TWO METHODS OF WINTERING BEES.

There are two methods in vogue. One is called the indoor and the other the outdoor plan. Which one the reader shall use depends entirely on locality. Where the winters are extremely cold, with *continuous* freezing weather prevailing through the cold months of December, January, February, and March, without warm days intervening, the indoor or cellar plan of wintering bees is the one usually followed. However, in such climates some prefer wintering in tenement hives where anywhere from four to ten colonies can be accommodated. In other places, say fifty or one hundred miles south of the great lakes, or where there is an occasional warm day, say one or two a month when bees may fly, the outdoor method of wintering in double-walled hives, or in single-walled hives with winter cases, is the plan generally in vogue. Throughout the Southern States the plain single-walled hives are warm enough without extra protection.

Fig. 2.—A deep telescoping cover to set over the packing-trays for out-door wintered colonies is preferable.

Indoor wintering in the colder localities does not require double-walled hives or winter cases; but when bees are set out in the spring, some protection should be provided.

Although cellar wintering requires less expensive hives, it involves more skill—especially so if the cellar or winter repository does not afford all the favorable conditions. Just what these are will be referred to later. While the outdoor method, on the other hand, demands double-walled hives, winter cases, or something to protect the hives on their summer stands, it does not require that degree of skill made necessary when the bees are confined in the cellar. Therefore the majority of beginners, especially where the climate is not severe, are advised to winter outdoors.

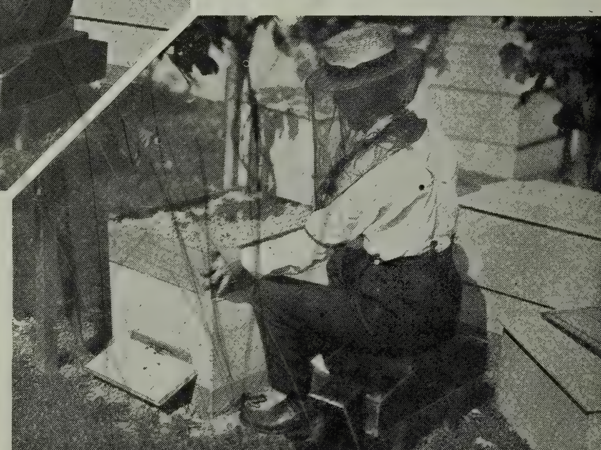


Fig. 3.—The top packing consists of a tray filled with planer shavings.

With either the indoor or outdoor plan it is fair to state that, after a very severe winter in which the mercury plays below the zero-point for weeks at a time, and when spring is very late, with a warm spell followed by a very severe cold one, losses are likely to be heavy. even among the most experienced beekeepers. See SPRING MANAGEMENT and SPRING DWINDLING. But these losses can to a very great

extent be minimized, even in bad years, provided one makes a study of his locality, regarding the average weather conditions that prevail. It will, therefore, be the object of this article to set forth as nearly as possible some of the difficulties to be encountered, so that the reader may intelligently undertake the problem. It is well to state, though, that the very severe winters referred to do not occur more than once in 10 or 20 years, when for some reason the whole year seems to be thrown entirely out of balance; but at all other times, if one follows carefully the directions here given his losses will not exceed ten per cent, and he may keep them down as low as two per cent. Indeed, some have wintered their bees winter after winter with a loss not exceeding five per cent, if we throw out of calculation the one year in ten which proves abnormally severe.

FIG. 4.—The super-cover is made of ⅜ lumber, tin-bound at the ends. This is put on the hive, and covered with the tray shown in Fig. 3.

FIG. 5.—Manner of pouring in feed from a common watering-pot into a Doolittle division-board feeder. After sufficient syrup is given, the feeder is removed, the combs are shoved over, a division-board inserted, and hive closed for winter.

OUTDOOR WINTERING.

This is the simpler plan for most beginners, and the principles involved help to lay the foundation for the more difficult problem of indoor or cellar wintering. The prime requisite for both methods of wintering is a large force of young bees reared during the latter part of summer or early fall. See SPRING DWINDLING. A colony made up of old wornout bees with very few young, no matter how strong, will be almost sure to succumb before spring, or reach such a weakened condition as to become practically worthless. As a general rule, in the Northern States brood-rearing ceases right after the honey-flow. This is perfectly normal where there is no late summer or fall pasturage like buckwheat; but during the latter part of August and the early part of September, brood-rearing should begin again; and unless there are natural sources of nectar the bees will require feeding with thin syrup given in small quantities daily to stimulate.* See FEEDING. This stimulative feeding should be continued long enough to get a lot of brood in the hive so there will be a strong force of young bees to go into winter quarters. See SPRING DWINDLING. In many localities colonies will be able to gather enough nectar daily to supply themselves with young bees without any special feeding. So far the scheme of raising a large force of young bees is an important requisite for either method of wintering, but especially important where bees are wintered outdoors subjected to extremes of temperature requiring a large consumption of stores in order to keep up necessary heat.

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* Better requeen and use soft sugar for food. —A. C. M.

Examining a colony in a double-walled chaff hive; the chaff-tray containing packing-material is shown at the left.

It is unwise to attempt to winter bees outdoors in single-walled hives north of 40 degrees north latitude. While the colonies may come through after a fashion, the shock of the exposure will be so great that they probably will not be good for much to gather honey. It is, therefore, important that the hives be protected from high winds, and that the walls surrounding the hive be double and warm. Special double-walled hives are manufactured, having the space between filled with chaff, planer-shavings, leaves, or other suitable material. See HIVES for detail of construction. The cover or roof should also be double so that the heat of the cluster will not too readily radiate away, thus causing a great consumption of stores in order to keep up the necessary animal heat; for it should be remembered that, the warmer and better protected the cluster, the less honey they require to eat. It is desirable to have the bees, so far as possible, enter a quiet state of sleep, or semi-hibernation. that practically amounts to a condition of suspended animation. See "Do Bees Hibernate?" further on. But an extremely cold spell will make it necessary for this cluster to unfold and consume its stores in order to keep up the temperature. When, therefore, a colony is so poorly protected that it has to overeat in order to keep warm, the bees will become distended, and dysentery or purging is almost sure to follow. This occurring in mid-winter or early spring means the death of the colony, as there is no cure for it but warm weather. See SPRING DWINDLING and DYSENTERY.

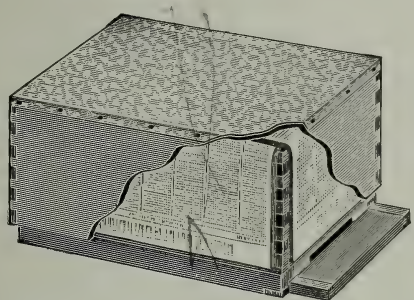
A hive having double walls well packed with warm cushions on top, and a good cover, makes about as good a winter home as it is possible to construct. A tray containing chaff, planing-mill shavings, or forest leaves resting under the telescope cover keeps the top warm. A large cushion may be used instead but is not so good.

Under the head of HIVES, subhead DOUBLE-WALLED HIVES, we have explained at length why the extra packing and double walls not only save in the consumption of stores, but eliminate to a great extent

winter losses. Before the reader proceeds further he would do well to go into this argument and then take up a fuller treatment of the subject here.

WINTER CASES FOR SINGLE-WALLED HIVES.

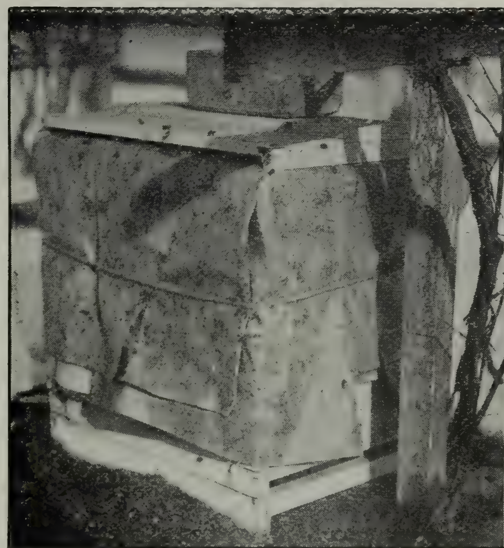
Because double-walled hives are somewhat expensive, many beekeepers start with single-thickness hives, intending to winter, perhaps, indoors. How shall they be prepared and yet give as good results, practically, as can be obtained from the more expensive double-thickness hives? Very good outside winter cases are obtainable from supply manufacturers, large enough to telescope down over the hive. The cover of the single-walled hive, if it projects over, as most of them do, should be removed, and what is known as a thin



Telescope cap

super-cover—that is, a thin board of the same width and length as the hive, substituted. Several folds of newspaper, old carpeting, or any other suitable material, should be laid crosswise and lengthwise over the top of the hive. Enough of them should be put on so that, when the winter case is put on, it will telescope over, crowding the folds of newspaper or other packing material neatly around the inner hive. The illustration herewith given will give some idea of the scheme here proposed.

Another plan, and possibly just as good, embodying the same principle but more laborious and not so cheap in the long run, may be employed. Instead of having a winter case made of wood, the protection is made up of a large square of medium-weight manilla or roofing paper, laid on top of folds of newspaper as before directed, and then neatly folded down on the sides and ends as one would do up a package, and tied with a string as shown in the accompanying illustration. It will also be important not to make the mistake of making the folds come down over the end of the hive in such a way that they will catch and hold water. In the next illustration the method of wrap-



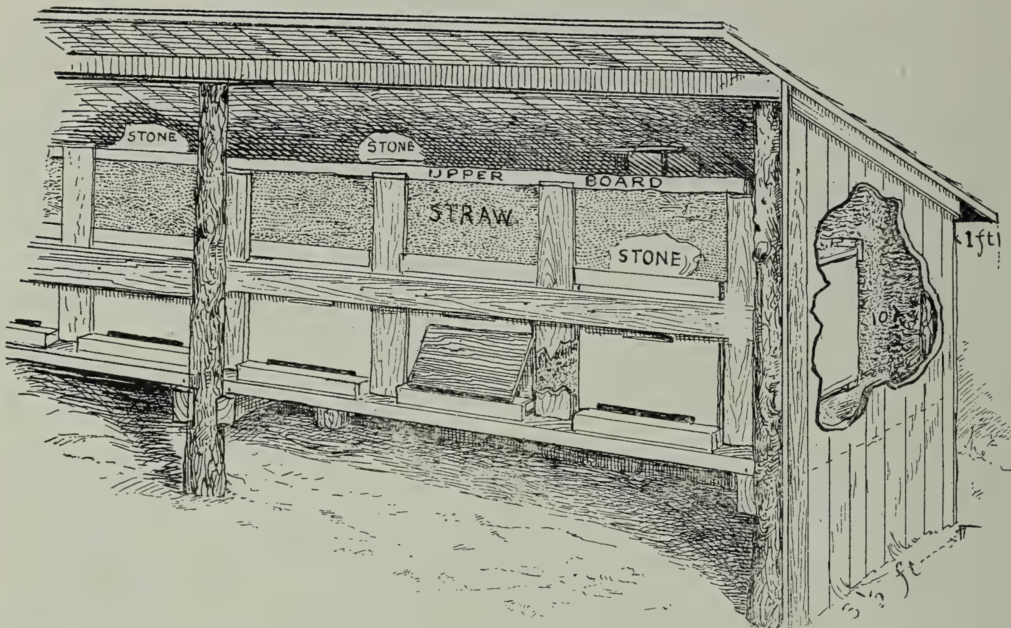
A winter case made of second-hand wrapping-paper as used at Medina.

ping and tacking the paper is shown. If one uses manilla paper it would, perhaps, be well to cover it with a coat of grease, or, better still, linseed oil. In the

Combination paper and wooden winter case.

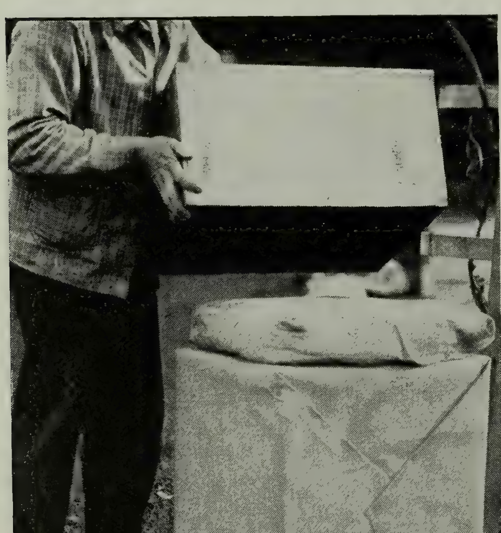
spring one can examine his bees by loosening the bowknot of the string, lifting off the paper cover, and finally the packing under it.* After examination, the paper

* Better examine by tipping up hive and looking up between combs.—A. C. M.



W. T. Davison's method of packing bees in straw for outdoor wintering.

can be readjusted as before, with the packing material underneath.



Paper winter case with chaff cushion placed on top.

In cold localities this packing should not be less than two inches thick. If one can not secure enough newspapers perhaps he can contrive some scheme for using old carpeting or grain-sacks, especially such as are unfit for any other purpose. He can usually obtain quite a quantity of these by going to the farmer or miller; and he may (and probably will) receive free all he can take away.

In selecting a roofing-paper for the purpose, avoid the heavy grades, as they are expensive, and do not fold readily; and, when folded, they will break on removing the string. A greased manilla paper, about like flour-sacking, gives very good results; any paper which will stand weather, and yet fold up flat again in summer after the cold winter weather and spring are over, will answer. The last two illustrations show a better arrangement—paper wrapping, a cushion, and, last of all, a wooden case to telescope over the whole.

Some use, instead of the string to fasten the paper down, strips of wood tacked on. These hold the paper close against the hive in a way the string does not. This is important, as it keeps out the cold.

Another method of protecting the single-walled hives is to get some old drygoods-boxes. Pile straw on top of the hives, then push the large box back over the hive. But as these boxes are of such varieties of shapes and sizes they are not usually

very satisfactory; and, besides, they do not shed rain unless covered wtih roofing-paper.

Another scheme is to put the hives in a row under a shed, leaving the point of least exposure in front. Straw is then packed in between the hives and in the rear, after which it is covered with boards to shed water. But working hives under a shed is very inconvenient in summer, and therefore one is strongly urged to adopt the winter-case plan if he can not afford double-walled chaff hives.

WINTERING BEES IN TENEMENT HIVES.

A tenement hive, as its name indicates, is one large winter case capable of housing anywhere from two to a dozen colonies in single-walled hives. It is usually composed of large cleated panels made of cheap lumber for the sides and ends, and with a roof of like material covered with roofing paper. The whole is held together at the intersecting corners by means of Van Deusen hive-clamps, or hooks and eyes or screws. When the bees are unpacked in the spring the panels are removed and laid away until the following September or October, when they are brought into use again.

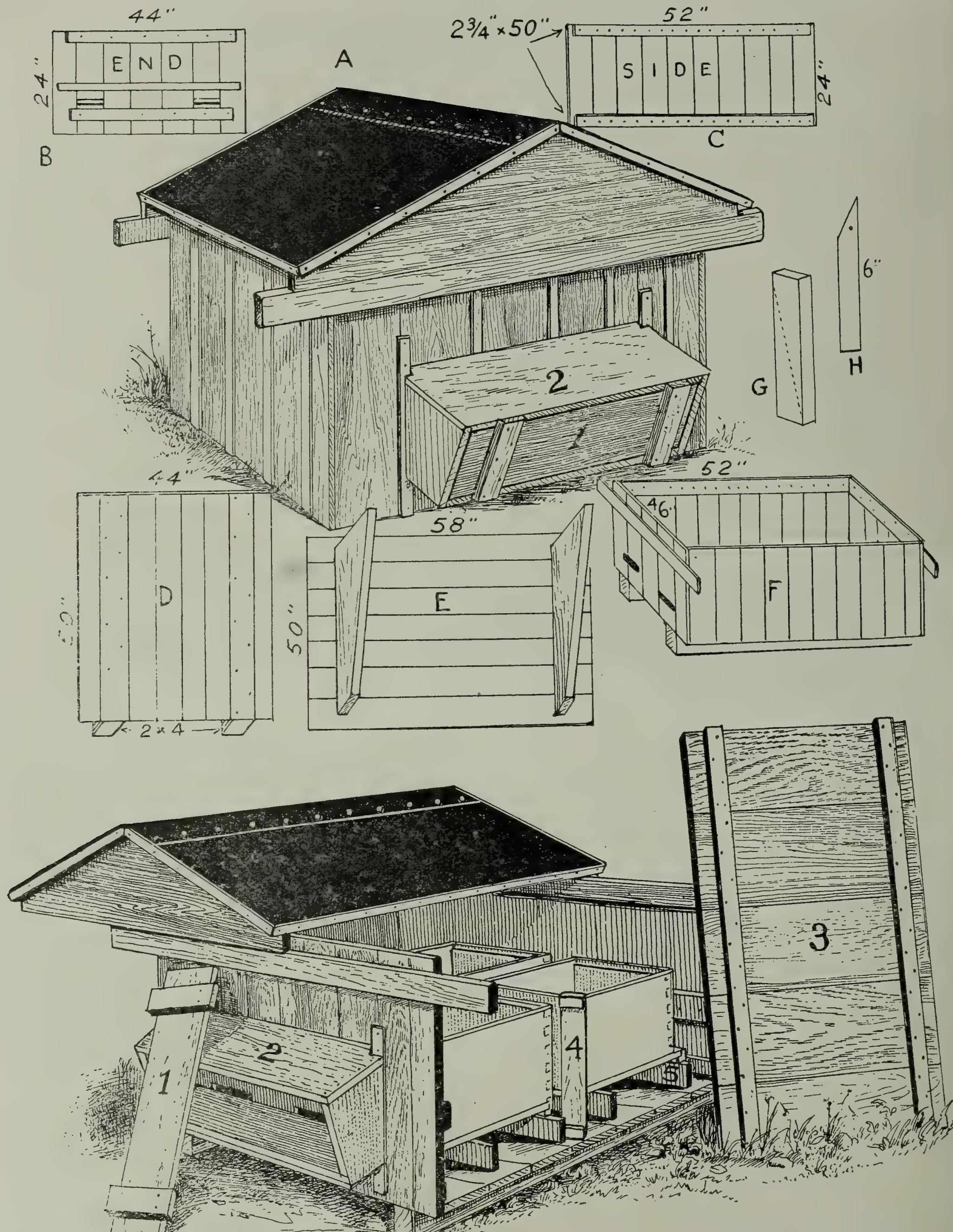
The tenement hive finds its advocates and users in colder climates—that is, climates where the ordinary double-walled hives do not give quite enough protection, and where cellar wintering generally prevails. But indoor wintering has its disadvantages, as we will show a little later. Many cellars are poorly adapted for keeping bees over winter. Special repositories built for the purpose are expensive; and even when the best conditions are provided it requires a good deal of skill to bring the bees through successfully from fall to spring. And this is not all. The cellar plan of wintering requires the moving of the bees in and out of the cellar. and more or less attention during the winter to provide for the varying degrees of temperature and the necessary ventilation. Mr. R. F. Holtermann, for example, whose bee-cellar is shown a little later on, gives the following reasons why he abandoned his $1000 bee-cellar, described further on, and has now adopted the tenement-hive scheme of wintering.


Townsend's method of protecting hives after setting them out in the spring.

When wintering in the above-named cellar my method was to remove the bees from the cellar and place them on stands. They were next taken to clover pasture, sometimes a distance of thirty miles. Next they were taken to buckwheat, and finally returned to the bee-yard in connection with the cellar.

By this method the hives and bees were unprotected during the spring, also in the autumn, until placed in winter quarters about Nov. 20. I was also compelled to be on hand when the cold weather began to moderate in spring, and there was always a good deal of anxiety as to the best time to set out, sometimes to find that, owing to conditions of weather, many bees had perished in their first flight, and others had drifted to the disadvantage of weaker stocks.

There are various styles of tenement hives. One of the simplest and best is the Bartlett, illustrated on next page. The cut renders the mode of construction so plain that further description will be unnecessary except to say that the several panels are held together by means of wood screws. The four hives are placed in contact with each other (for the purpose of conserving the heat of the clusters) when the space



Bartlett's winter case for holding four ten-frame colonies; lower illustration showing interior.

between the group of hives and the winter case is filled with packing material, consisting of planer shavings, forest leaves, straw, or chaff. Mr. R. F. Holtermann uses a tenement made out of cheap half-inch boards, and he thus describes it:

As I now winter the bees shown in the illustrations in connection with this article, four twelve-frame Langstroth hives are wintered in an outer case; two hives are placed in the case side by side, and another two also side by side, but back to back with the first pair. This makes two sides of each hive have the best of winter protection—namely, the protection of other hives warm with bees.

The cases consist of a platform of half-inch boards nailed upon three cleats 1x4 inches, the two at each end being on edge, to give strength. The three cleats extend half an inch beyond the side of the platform, and are so arranged that the two at the ends project half their thickness beyond the ends of the floor-boards.

View of one of the Holtermann yards; the colonies are often left in these tenements until clover-bloom.

By this construction the half-inch siding lumber may extend down past the floor, and rest upon the half-inch projections all around, protecting all from lodging water and snow. The sides and ends of the case are made of tongue-and-groove material, ½ inch thick, 23 inches high, and therefore make a case deep enough to hold an extracting-super on top of each hive. This half-inch stuff is kept together and strengthened by a cleat on the inside, 1x2 inches, and half an inch shorter than the side or end is high, namely, 22½ inches. These cleats come even with the top of the case, but are ½ inch short at the bottom, the object being to allow the side or end to extend the half-inch below the top of the platform, and rest on the end of the bottom cleats, as mentioned.

The cover of the case is made of half-inch material nailed at the ends to 1x2½-inch cleats. These latter cleats extend down over the case. They strengthen the cover; and if the locality is windy they can be fastened to the case by means of hooks. The lumber is covered with roofing-paper, nailed to the wood part of the cover, and made water-tight by the judicious use of roofing cement. The cases, from the above description, will be seen to have a perfectly level or flat cover. They can

The cover of Holtermann's tenement hive removed, and leaves taken out to show the hives underneath.

be made to shed water by slightly raising one side of the case.

The bees go in and out through the case by means of ⅞-inch round holes. Three are recommended, but I will confess I have found that size of entrance inadequate in the spring before removing from the case, as I leave the bees packed sometimes until clover is opening, having many supers on before removing from the case.

The case is set on blocks 8 to 12 in. high, one at each corner. This takes them above water and ice which may lie or form on the ground. There are no supports for the center cleat, as this is held up to the case by means of galvanized iron straps 6x1 inch, binding it to the siding. Considering the tendency to settle and heave, it would be practically impossible to support the case evenly at six points, and by using the above device it is unnecessary.

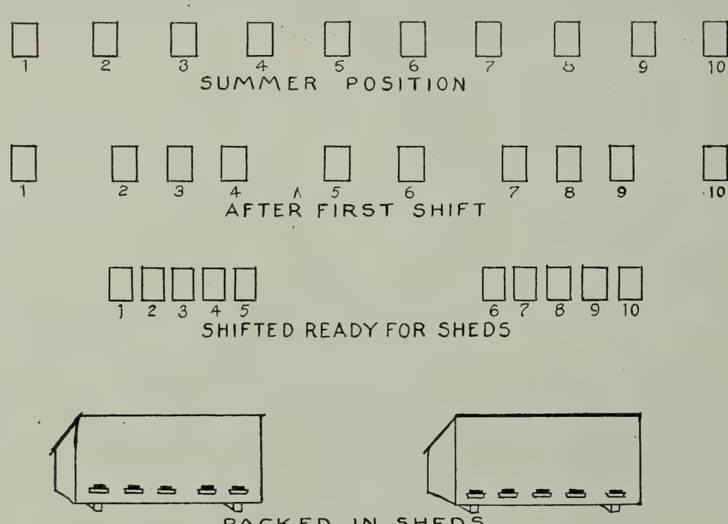
Mr. G. C. Greiner goes one step further, in that he winters five hives in a tenement.

All the tenement hives here shown are made up of cheap lumber. The panels are cleated, and held together by hooks or screws. As soon as the winter is over, and settled warm weather has come, the packing is removed and the panels taken down and laid away for the season. The Greiner method of wintering contemplates the plan of removing the hives from their summer position to the winter position, so that they can be covered by the tenement sheds. The method of making that shift Mr. Greiner explains as follows:

To explain fully the proper way of moving bees successfully—that is, without any loss of bees—I refer the reader to the accompanying drawing. The upper row shows ten colonies as I work them for extracted honey during the season. They are equally spaced with two feet in the clear between the hives.

The second row shows the same hives after the first shift is made. The four hives, 2, 4, 7, 9, are moved their width toward the center hives 3 and 8. After two or three days (and, of course, I mean flying days), when these shifted colonies have again become accustomed to their new location, the end hives of each section of five, represented by the figures 1, 5, 6, 10, may then be slightly moved toward their respective centers. Under no consideration should these latter be shifted at the same time when the first shift, Fig. 2, is made. That would bring their new stand too near the stands of those just moved, so that more or less mixing up would be encouraged.

The third row shows the ten colonies in position ready for the sheds. If carefully managed, and if the shifting has been done according to the hints here given, they should arrive at these places without the loss of a single bee.



G. C. Greiner's arrangement of hives before and after putting in winter-cases.

This form of tenement, however, we do not regard as quite the equal of the Bartlett or the Holtermann. Relatively it has a greater amount of exposed surface to the colony. Then we believe it to be an advantage to place the hives in *tight contact* in order that the bees may borrow warmth from each other. Mr. Holtermann and Mr. Barlett, if we are not mistaken, keep their hives running all summer in groups of four a few inches apart. This avoids all shifting from one season to another, and yet allows the owner to have one side and one end as a means of approach in handling. When it comes time to put the bees into winter quarters, there is no lifting nor shifting, except to place the hives

in direct contact, when they are ready to pack for winter.

It is our opinion that the average beginner in the colder climates will succeed better with the tenement plan of wintering than he would with the most up-to-date bee-cellar.

IMPORTANCE OF LETTING BEES FORM A WINTER NEST.

What do we mean by "winter nests"? We mean a space of empty brood-cells in one or more combs, such space approximating the form of a hemisphere in ordinary Langstroth brood-nests. These empty cells surrounded by sealed stores constitute the winter nest where the bees cluster when conditions are ideal. As the stores are consumed, the number of empty cells increases either backward or forward, but always upward. As a general thing we find the ball of bees located near the front of the hive and regularly over the entrance. As the stores are consumed they move upward and backward; but the cluster in no case extends over the sealed honey when the bees can have their own sweet will.

Very often a well-meaning A B C scholar finds three or four combs in the center of the hive, having a space of empty cells as large as the hand spread out. He thinks this is all wrong and will remove the combs containing such spaces, and put in their place *solid combs of honey.* What has he done? He has compelled the bees to cluster upon sealed honey. The cluster is broken up into slabs approximately 3/8 inch thick, each slab of bees separated by approximately an inch of solid honey. Instead of having one solid cluster separated by only the midrib of the combs, he has made a series of clusters, each within itself trying to maintain its own body heat but at a very great disadvantage.

Let us illustrate: Two people on a cold winter's night require less bed clothing than one person would in that same bed. Now, then, suppose that, instead of having those two bed-fellows separated from each other by only their night clothing, we have a slab of metal or even wood between them. If they are compelled to place their warm bodies in contact with that cold surface they lose a great deal of their body heat because the cold surfaces carry away (that is, dissipate) the warmth.

We have exactly that condition when we insert combs of sealed honey into a bunch of bees. We compel them to divide up into four or five clusters. The result is, that colonies tampered with in this manner perish or come out in the spring very weak because of their inability to maintain the requisite temperature. Where outside bees become stiff with cold they can not long endure that condition.

If a colony is fed gradually during October and November they will form this winter nest. If, however, they are on the verge of starvation, and they are fed 30 lbs. in a single night toward the last end of the fall, or when it is quite cold, they do not have the opportunity of forming this nest. They will carry the syrup down while it is hot; then for a few days after that, if it is so they can fly, or, rather, so the cluster can move freely about the brood-nest, they may or may not rearrange the stores. The cluster, when it actually forms up for winter, will be practically one homogeneous mass of bees separated by only thin cells walls and the midribs of the combs.

If anybody doubts that bees try to have a winter nest, let him break into several clusters of bees when the temperature is down to about 5 above zero, in an outdoor colony. We have done this repeatedly. If the arrangement of combs has not been disturbed in the fall, we will probably find the bees tightly jammed into the cells. And, again, we will often discover, as we go over our colonies in the late winter or early spring, that some of them have actually starved to death. In all such cases we will see dead bees tightly packed in the cells of the winter nest, and a solid mass of bees between the several spaces between the combs. Starvation is often due to the fact that cold weather has continued so long without a let-up that the bees are left high and dry, so to speak, in the center of the winter nest. They actually starve, notwithstanding that sealed honey is within two inches of the cluster. The long-continued cold has given them no opportunity to warm up and shift the cluster over in contact with the sealed honey. We have seen this condition almost every winter in our yard.

Still again, we have often found dead colonies where some of our newer men in

the bee-yard had disturbed the combs, putting a solid comb of honey right down through the center of the winter nest. This made two bunches of bees; and both, being too small, died.

When it comes to indoor wintering, especially where the cellar temperature does not go below 45 F., a winter nest is not so vitally necessary. But if the temperature goes down below 45, then the absence of a winter nest may mean the death of a colony.

Nature has worked out this problem of wintering bees; and when we tamper with her plans we tamper with our pocketbook. While we can do certain things contrary to nature, we can not interfere with her plan in the arrangement of the combs.

NON-POROUS COVERS OR ABSORBING CUSHIONS OVER THE CLUSTER OF BEES.

There has been considerable discussion in the bee-journals over the question of whether there should be loose porous absorbing-cushions or other material placed above the cluster of bees so that the moisture from a cluster can pass up into the packing, or whether, on the other hand, the top of the hive should have a thin board or super cover on top. In the milder climates it seems to be pretty well proven that the wood cover over the bees brings the bees through in better shape. In the colder climates, such as Northern Michigan, Canada, Northern Wisconsin, Minnesota, and Northern New York, a porous covering seems to have somewhat the preference, although we find advocates of the solid-cover principle in these localities. If there is danger of the entrance becoming closed by deep snows or ice for weeks at a time, upward ventilation through porous packing would probably be safer, for bees must have air.

When the top of the hive is closed tight, the moisture from the bees collects on the under side of the cover, drips down, and passes out at the entrance. The absorbing cushions, on the other hand, in our climate often become damp and soggy before spring. When in that condition they will sometimes freeze; and, so far from being a protection, they are a positive detriment. But where the climate is cold and dry, the temperature going down to 10 or 20 below zero, the absorbing cushions will be less damp than in a milder climate subject to more or less humidity on account of moist or rainy weather. When absorbing cushions are used, there must be a space of at least one inch over the top of the packing. In addition, there should be ventilating-holes so that the moisture can escape. But these holes should be so situated as to prevent rain or snow from blowing in.

When non-porous covers are used, it takes less packing than when the absorbing plan is employed; but the entrances must be kept clear. If one has not decided which scheme to adopt, we suggest that he try the two side by side. We have tried sheets of glass the exact size of the tops of the hives. These are imbedded in putty, making a tight sealing between the glass and the hive. The packing material is then placed on top. We have wintered most successfully anywhere from one to a dozen colonies, during successive winters, under these sealed glass covers—not because there was any merit in the glass, but because we could better observe conditions. We could never see that this moisture that collects in drops at the corners ever did any harm.

BEST KINDS OF PACKING MATERIAL.

Wheat or oat chaff, preferably the former, has been recommended as being the best material to use; but since the advent of new methods of separating the chaff from the wheat by means of a suction-fan, it is not now easy to obtain the chaff. We now recommend dry forest-leaves, plenty of them, or planer-shavings. Cut straw does very well. In milder climates, two thicknesses of old carpeting or burlap sacking will do. In colder climates we could use not less than six inches of packing. If the absorbing scheme is used, eight inches will be better.

SIZE OF ENTRANCES.

Under the head of ENTRANCES, to which the reader is referred, it is shown that the entrance should be reduced down so as not to be larger than 3/8x8 inches; and in the case of some of the smaller colonies it would be better to have the openings 3/8x3 or 4 inches. In all cases of outdoor

wintering it is important to keep these entrances clear, and it may, therefore, be necessary to rake out the dead bees now and then which may accumulate; for should the entrance become clogged the death of the colony must follow. See SPRING DWINDLING.

WINTER STORES — QUALITY AND QUANTITY.

We have now considered the inclosure, or the hives themselves, for holding a colony for outdoor wintering. Something should be said about the quantity and quality of the stores. It is fair to say that bees outdoors consume nearly twice as much as those indoors; but it is argued, on the other hand, that while the former consume this larger proportion of food they keep stronger numerically and will be in better condition at harvest time than those wintered indoors on half the amount. The opinion of the beekeeping world is somewhat divided on this whole question; but certain it is that he who winters outdoors should provide twice the amount of stores, or at least see that his colonies, after the main brood-rearing has ceased, have from 20 to 25 lbs. of sealed stores. The beginner will need to weigh up his combs for the first colony or two, to be able to estimate approximately the stores of other colonies.

As a general thing an eight-frame colony should be crowded on six combs, and a ten on an eight. The division-board must be shoved up close to the frames, and empty space, if any, filled with leaves or other packing material. It is desirable that bees have stores given to them at least a month before they go into their winter sleep, so they may have a winter nest around which will be sealed stores within easy reach. As to quality, there is nothing better than pure granulated-sugar syrup, although any good first-class table honey, if well ripened, will give as good results. Many beekeepers pursue the policy of extracting all the honey and feeding sugar syrup. At the present price of sugar and honey one can afford to do this; and, moreover, the very act of feeding will stimulate rearing young bees. This in itself is worth all it costs.

Although a colony has sufficient stores by the middle or latter part of August it may run considerably short by the first of November, especially if a fall flow induces brood-rearing. In any case it is well to go over the colonies just prior to the final preparation for winter, and make sure they do not run short. This is very important as many a colony has been lost through starvation when their owner supposed they had enough to last till spring.

BEES FLYING OUT ON CHILLY OR COLD DAYS AND APPARENTLY DYING ON THE GROUND.

In a late winter or early spring, bees will very often fly out on a bright day, whether it is very warm or not. They alight on the ground or some object, become chilled, and apparently die. Cases are on record where bees have flown out, alighted on the ground, become stiff and cold, and were apparently dead. There was one instance in particular of this kind where thousands of bees had flown out and lay on the ground apparently never to return. A cold rain set in and then it began to freeze, followed by some snow. This freezing weather lasted for a couple of days. This was followed by warm sunshine, when, wonderful to relate, those dead (?) bees came to life, took wing, and flew back to their hives. Other authentic reports, showing something similar to this have been sent in. It seems almost unbelievable, but the facts are, that bees can fly out, alight in the snow, chill through, and seem to be dead. If the snow is not too deep it melts away so that the bodies of the bees can become warmed up, when they will often revive; they always revive, if it is warm enough, and they have not been chilled too long.

Beekeepers have written in at many different times, fearing that their bees had flown out in late fall, and, becoming chilled on the ground, were utterly lost; but when a warm day comes on a little later, these bees, if it has not been too cold, will return to their hives.

Old Dame Nature seems to have made some wonderful provisions to preserve bee-life. We are therefore constrained to believe that bees can stand, under some conditions, chilling cold for some days without killing them. See BEE BEHAVIOR; also "Do Bees Hibernate?"

WINTERING IN CELLARS OR SPECIAL REPOSITORIES.

In discussing methods for wintering bees outdoors, we have already given some principles that apply to cellar wintering. In the first place, we may say that bees do not require more than 10 or 15 lbs. of stores per colony, although it is an advantage to have more, because it is difficult to feed bees in the spring. With a strong force of young bees and good stores we are well equipped to winter bees in the cellar, provided we have reasonable control of temperature and means for ventilation. Before we go into the general subject of cellar wintering it is, perhaps, important to specify two or three

IMPORTANT REQUISITES FOR A GOOD BEE-CELLAR.

First is the *control of temperature.* The ideal temperature is about 45 degrees F. It may go up to 50 or it may go down to 40; where possible the extreme should not exceed these figures. A greater variation early in the winter does less harm than later. As the winter approaches spring it becomes increasingly important that the temperature be held as nearly as possible at 45. When we say 45 we mean the reading of a *tested* thermometer. Cheap thermometers are often worthless for cellar use. If the temperature goes too high the windows should be opened at night—never in day time—to let in air, and closed just before daylight. If it becomes too cold, so the temperature goes down below 40, or near freezing, artificial heat must be used. To that end a small stove connected with a chimney may be used to advantage. Build just enough fire to raise the temperature to 45 or a little more. As a general thing it will not be necessary to have a stove; for enough bees in the cellar will keep up the temperature by their own body heat. If a repository during the winter can not be kept cool enough by opening the windows at night, and closing them in the morning, it goes to show very plainly that the beekeeper should adopt outdoor wintering, as his climate is not cold enough to keep a cool cellar.* A cellar that has a tendency to be too warm most of the time is a very poor place in which to winter bees. But one where the temperature can be kept uniformly at 45, not varying more than two or three degrees through the day, will not require so much ventilation as when the range is greater. Such a cellar must be mainly under ground, and should have double doors to shut out frost, as well as double windows, if any. A uniform temperature of 50, with plenty of ventilation to the cellar, will give equally good if not better results.

It is important that the cellar be kept dark at all times; and by *dark* we mean absolutely so, without any light penetrating anywhere.

It is important, also, that the cellar be reasonably dry, although bees have wintered fairly well in damp cellars. If it is damp, the bottom muddy and the temperature down much below 45, the effect on bees will not be satisfactory.

VENTILATION.

The question of air change depends almost entirely on the temperature of the cellar and its control. If the mercury can be kept uniformly at 45 throughout the entire winter with not more than two or three degrees variation it may be said that very little ventilation of the cellar will be needed; but if it has a tendency to go to 50 or more, then down, and especially if the bees begin to roar, showing uneasiness, then it is *very* important to let in large quantities of fresh air by opening the cellar-windows at night, or through sub-earth ventilators, as used by some. But if windows are opened they must be closed before daylight in order to shut out light. Some have found it better to let fresh air into an outer cellar and from there into the inner cellar where the bees are. It has been argued that air directly from outdoors has a tendency to stir up the bees; yet we have not found it so. Our experience is that, when bees are uneasy by being too warm, it is also because the air is foul.* The obvious remedy is to let in cool air from the outside to reduce the temperature, and at the same time supply fresh oxygen.

Cellars should be large in proportion to the number of bees kept in them. A room 12 by 12, and 7 feet deep, will winter 50 colonies much better than it will 100. Ten colonies will come through in better con-

* *Good.* —A. C. M.

* Right you are.—C. C. M.

dition than 50. The reason of this is simply a question of pure air. In some cases one may have access to a larger cellar that opens up into other compartments. If these compartments are not used, leave the doors open so that the air of the entire cellar can be available for the bees. A bee-cellar only 10 by 10, 7 feet deep, should not be used to winter more than 100 colonies, and will give better results with 50. A larger number may, of course, be crowded in, and will winter properly if enough ventilation can be given both day and night, keeping the temperature down to about 45. See VENTILATION elsewhere.

SUB-EARTH VENTILATORS.

The sub-ventilator should be from four to six inches in diameter, made of glazed tile, about 100 feet long, and from four to six feet below the surface of the ground. The outer end is brought to the surface of the ground, and the inner opens near the bottom of the cellar. Cold air entering the ventilator is warmed in passing under ground and until it enters the cellar, not only supplies the latter with pure air, but at the same time raises its temperature several degrees.

SPECIAL REPOSITORIES OR A CELLAR UNDER THE HOUSE.

The ordinary cellar under a dwelling-house often affords excellent conditions for wintering bees. Where a furnace is used it should be shut off from the bee part by means of a brick wall having a door. Should the bee-cellar get too cold the temperature can be raised by opening the door leading into the furnace-room. When too warm, one can open an outside window; or, perhaps, better still, swing wide the cellar-door leading into the furnace, and thence, when tempered, into the bee-room. Hives properly shaded to shut out the direct rays of light will permit the doors left open day and night. If the temperature in the bee part can thus be maintained approximately at 45, the conditions for wintering will be ideal, for a perfect bee-cellar is one where the temperature can be held at about 45, and fresh air admitted every hour of the day. But if opening the cellar-door reduces the temperature that is otherwise uniformly at 45, or causes it to rise, it would be better to keep the bee-cellar closed—not because the ventilation does harm, but because the change of temperature does. House cellars are very often too small, perhaps lack room to put in bees and vegetables. And right here let us say it is a bad practice to put bees and garden truck together in the same room. They should be kept separate.

Objection has been raised that the noise overhead in the house cellar disturbs bees; but no absolute proof has been adduced to show this. We have had some excellent results in wintering in a bee-cellar under a machine-shop where rumbling machinery every now and then was accompanied by the bumping of heavy castings. We have never been able to discover that this noise interfered with good wintering in that cellar.

But where a house cellar is damp, too small, too cold, too warm, or too something else, it may be well to construct a special repository for the bees. This should be located in a side-hill if possible. A little later on we give illustrations of cellars used by some extensive beekeepers; also other schemes of ventilation.

ARRANGEMENT OF HIVES IN A BEE-CELLAR.

They may be piled up one on top of another in such a way that any one can be removed without disturbing more than the one or two above it. The reason for this will be apparent later. Strong colonies should be put in first, and placed on a 2x4 scantling. On top of these may then be placed the weaker ones. This has no special advantage except the convenience of having the heavy ones at the bottom and the light ones on top. The entrances of the hives should be left about the same as they were during the late fall—3/8 deep by 8 inches wide. Some consider it essential to remove the bottom of the hives entirely. Others consider it good practice to have a deep space under the frames by raising the hive off the bottom in front and supporting it there by a couple of blocks. But some disastrous results in wintering seem to show *us*, at least, that too much bottom ventilation is bad unless the cellar is kept at a temperature of about 60 *and thoroughly ventilated*. The bee is essentially a warm-blooded animal. We have uniformly secured the best results with a reasonably small entrance, or one

about the size used during the fall or late spring. The larger the colony, of course the larger the entrance that will be required. In the case of a strong populous colony we would have the entrance 3/8 deep by the full width of the hive. The colonies of medium strength should have the entrance reduced accordingly. See ENTRANCES.

INSPECTING THE BEES DURING MID-WINTER; AND DEAD BEES ON THE CELLAR BOTTOM.

Experience has proven that, when the temperature is maintained at 45 degrees, very little attention need be paid to the bees, especially in the fore part of the winter. But during the last month or two of confinement the bees require watching more carefully; for if they get to roaring many of them will be lost. It then becomes necessary to make frequent examination to determine the temperature and the quality of the air. It will also be found, perhaps, that a good many dead bees will be found on the cellar bottom. While this is not necessarily a cause for alarm, it is not as it should be. If the cellar and temperature are right there will be very few dead bees, but if they accumulate their dead bodies should not be allowed to stench the living bees but should be swept up perhaps every two or three weeks and removed.

A disposition to roar should be met by more ventilation, and at the same time the temperature should be reduced. If all the colonies in the cellar should become uneasy during mid-winter it is evident that something must be done at once or the whole lot of bees will be lost. They ought not to become uneasy until late in the spring. If they can not be quieted by infusion of fresh air it may be best to give the uneasy colonies a flight on the first warm day by setting them outdoors and letting them stay there for 24 hours or until they can clean themselves. Dysentery or diarrhea in the bee-cellar is generally the result of too much cold air or too high a temperature, either of which will induce too large a consumption of stores; and where bees are not able to void their feces, the intestines become distended, resulting in purging. A colony so affected should be removed as soon as a warm day comes.

WHEN TO PUT BEES IN THE CELLAR, AND WHEN TO TAKE THEM OUT.

This is a question that depends entirely on locality. Most bees go into the cellar in the Northern States anywhere from the last of November until the first of January; but usually it is advisable to have all bees in before Christmas. As to when the bees should be taken out of the cellar, authorities differ. Some set them out in March, and then put on winter cases. See SPRING MANAGEMENT, and SPRING DWINDLING. Others believe it is better policy to keep bees in late or until the last cold weather is past, and then set them out. We would advise taking the golden mean, waiting until the time natural pollen comes, or, in our locality, soft maples bloom. But when bees are uneasy in the cellar it is advised to set them out earlier than otherwise.

TIME OF DAY TO TAKE BEES OUT.

The usual plan for taking bees from a cellar in the spring is to wait until fairly settled warm weather has come, and then on some warm bright day all the colonies are removed at once. The great trouble with this method is that the bees are likely to become badly mixed, owing to their eager flight without carefully marking the location. This results in a bad state of affairs, and should be avoided.*

Another method followed to some extent is to put some of the colonies out during an evening when all appearances indicate that it will be warm and bright the next day. A third of them, perhaps, are taken out, and these fly quite well the next day. The next evening another third is removed, and the last third the night following. The great trouble with this plan is that the bees removed first get to flying well and then start to rob colonies taken out later, thus making a fearful uproar.

Mr. E. W. Alexander, in *Gleanings in Bee Culture,* page 286, Vol. XXXIV., gave a plan open to none of these objections. In his own words it is as follows:†

"First get every thing all ready for a big job, and watch the weather closely, especially after a few nice days, for it is

*Some say this trouble is avoided if entrances are contracted to an inch or less as soon as bees are set on stands.—C. C. M.

† The most rational plan in use.—A. C. M.

quite changeable at this time of the year. Then when the wind gets around in the east, and it commences to become overcast with heavy clouds, and has every appearance of bad weather for the morrow, we commence about sundown and carry out all our bees—yes, even if it takes not only all night but into the next day; and if it commences to rain before we are done, all the better, for we don't want any to try to fly until they have been out two or three days if we can help it. By this time they will have become nice and quiet; and when a fair day arrives they will commence to fly, only a few at a time, and get their location marked, so there will be no mixing up or robbing, because they all have their first fly together. Then when the day is over we find by examining our hives that nearly every one has apparently retained all its bees."

SHALL WE PUT THE COLONIES BACK ON THE OLD STANDS IN SPRING?

There is this advantage in putting the colonies back on the stands occupied the previous season: Mr. H. R. Boardman letters each row in his apiary, and numbers every hive, each body and bottom-board bearing the number and the letter of its respective position. In the spring, in carrying bees out he is able to deposit his hive right where it was the preceding fall. "C6," we will say, is to go directly to the C row, and on arrival it is replaced on bottom No. 6. Mr. Boardman does not attach very much importance to bees being put back upon their old stands; though if he can, just as conveniently, he prefers doing so, because some old bees will go back to where they were the previous fall.

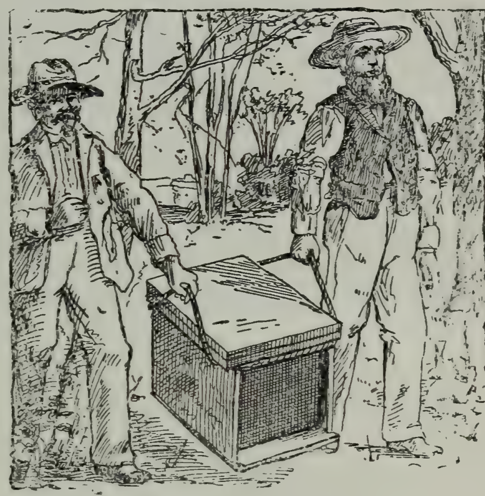
CARRIERS FOR HIVES.

A wheeled vehicle is not as good for moving bees in and out of a cellar as some

sort of carrier. There are several good ones and we here show a few.

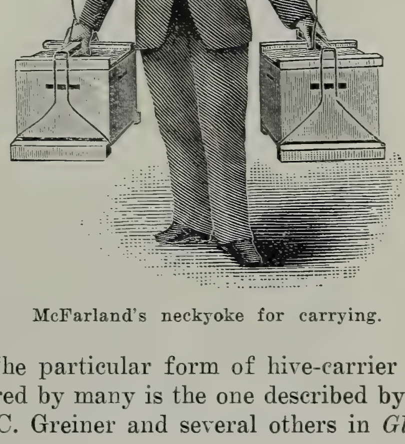
For hives without projections a pair of U-shaped wires bent to form a sort of bail answers nicely. The bottom hooks catch on to the bottom of the hive as shown.

Dr. Miller uses a rope as seen in the next cut. Of course, it can be used only when the hives are cleated at the ends.



Miller's rope carrier.

Where hives are carried any distance, and help is scarce, the yoke can be used. One man can carry two heavy hives quite easily; descend cellar-steps, and go through doors. The only objection is the rigging, and loading and unloading.

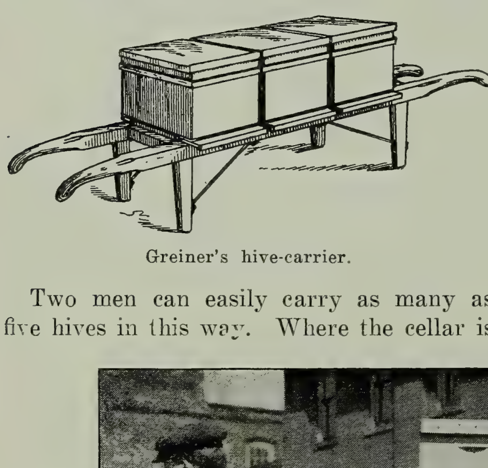


McFarland's neckyoke for carrying.

The particular form of hive-carrier preferred by many is the one described by Mr. G. C. Greiner and several others in *Glean-*

Carrying hives on two poles.

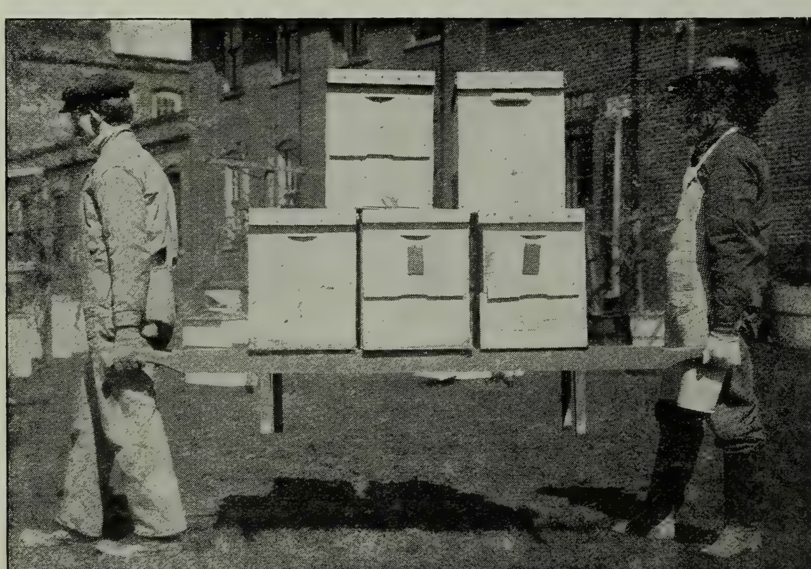
ings in Bee Culture. This is presented in the following illustrations.



Greiner's hive-carrier.

Two men can easily carry as many as five hives in this way. Where the cellar is located some little distance from the apiary we believe this to be the most convenient method yet devised.

Instead of constructing a regular hive-carrier as shown, it is possible to get along quite well by the use of two poles. See illustrations, this page. These should be about two inches square and six or eight feet long. They are placed on the ground in a parallel position, and as many hives placed on them as can be carried; perhaps three hives would be all that could be managed easily with the poles. It is much more satisfactory, however, to have the poles



Carrying hives from the cellar at "The Home of the Honeybees."

nailed together with a framework, making a regular hive-carrier.

In the large illustration, next page, Mr. R. F. Holtermann, already referred to under the head of TENEMENT HIVES and CELLAR WINTERING, illustrates the best method of carrying a hive into the cellar. Positions 4 and 6 place a strain on the back, and 4 particularly interferes with the free action of the legs in walking, and, moreover, does not give a good grip to the fingers. Position 5 enables the apiarist to walk comfortably to the bee-cellar, where he can deposit his load.

A FEW CONCLUDING FACTS ON INDOOR WINTERING WELL TO BEAR IN MIND.

1. Too low a temperature (below 40 Fahr. if long continued) in a bee-cellar will kill bees.

2. An excess of dampness in a cellar does no harm, necessarily, providing that the temperature is high enough, not lower than 45 or 50.

3. A low temperature, lower than 40 Fahr., and an excess of dampness, is a very bad combination, and will kill bees almost invariably. A high temperature, above 45, *but little or no ventilation*, will cause the bees to be uneasy. If the temperature is above 45 there should always be some ventilation. It should be continuous rather than intermittent at night, but better intermittent than no ventilation.

4. Bees can be wintered in a cellar without much ventilation, providing the temperature is held uniformly between 43 and 45, but they will winter much better if there is some fresh air.

5. A cellar may be too dry, for bees in a cellar require a little moisture. If there is no moisture, possibly a wet sponge should be put in front of the entrances of some colonies.

6. Ideal conditions are, a nearly uniform temperature of 45 Fahr., a slight amount of moisture, *continuous* ventilation, and absolute darkness.

7. A very bad combination is a constantly varying temperature that goes down nearly to the freezing-point and then rises sometimes to 50 and 60 degrees. Such a variation is almost sure to cause disastrous losses before spring.

8. A high temperature, between 60 and 70, requires a great deal more ventilation than a temperature of 45. The higher the thermometer the more fresh air there should be. Too much can not be given when the thermometer shows 65 degrees.

9. The statement has gone out that bees do not need ventilation in a bee cellar. Fair results are sometimes secured with only the air that percolates through the walls when the mercury can be maintained at 45 degrees, or within two or three degrees of it; but far better results are obtained when there are continuous infusions of fresh air through ventilators or doors or windows.

10. Occasional disturbance from the beekeeper entering the cellar does no harm.

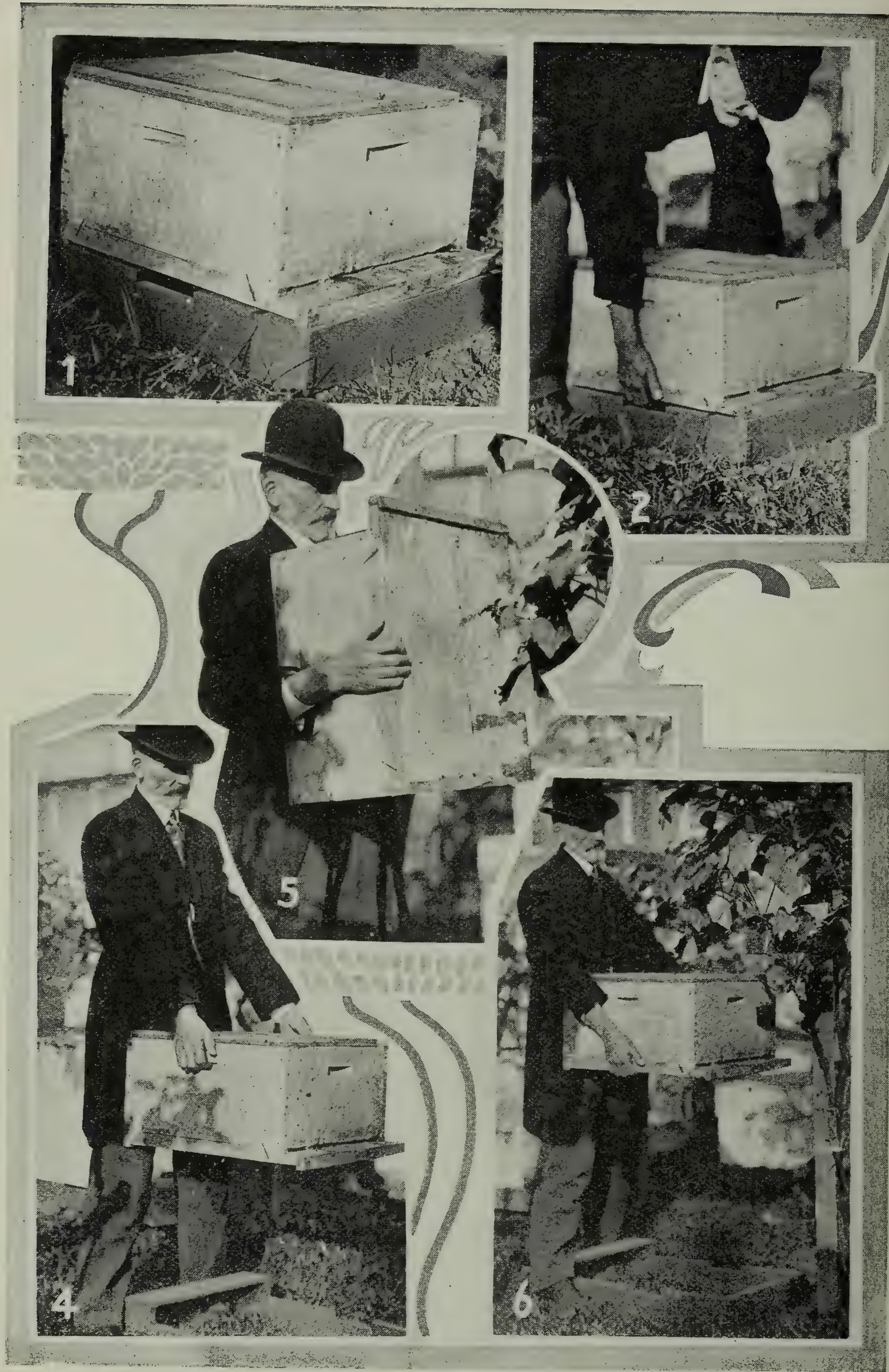
11. Where the conditions in a cellar are such that there will be anywhere from three to four or even six inches of dead bees on the cellar bottom in the spring we should say that the owner of that cellar ought to investigate and ascertain the trouble. No matter if he does bring his colonies through alive, it could hardly be said that he is wintering his bees successfully. An ideal cellar is one that will bring the colonies through the winter in practically the same strength as when they went into winter quarters. We have seen a good many cellars where all the dead bees that would fly out on to the cellar bottom would not in the spring make a coalhodful to the hundred colonies. We have wintered bees at Medina time and time again in one of our cellars so successfully that one could walk across from one end of the cellar to the other in the spring and scarcely step on a single dead bee. Do not let any beekeeper get it into his head that these old bees are superannuated and would die anyway. In any cellar where the conditions are such that there will be two or three inches of dead bees on the cellar bottom in the spring, there is something wrong.

12. Honey-dew or very inferior or an unpalatable or poorly ripened honey may cause dysentery before spring, even when all the other conditions are ideal.

13. Pollen in the combs does little or no harm. The old theory that pollen was the cause of much of our winter losses is now an exploded myth.

14. The size of entrances will depend upon the character of the cellar.

15. Shutting bees in the hives with wire cloth is usually attended with uneasiness;



How R. F. Holtermann carries his twelve-frame hives into the cellar. He lifts the hive as shown in Fig. 2, and then brings it up against his body as in Fig. 5. Positions in 4 and 6 put an unnecessary strain on the back, and interfere with walking.

and, unless removed, there will be severe mortality.

HOW AND WHAT TO FEED BEES DURING MID-WINTER.

It is advisable to avoid feeding any syrup during mid-winter, because it has a tendency to stir up the bees, causing them to consume too largely of their stores; and, as they can not take a cleansing flight, dysentery is likely to follow. Moreover, the feeding of a single colony in a cellar is apt to stir up, by its roar, the other colonies near it.

When an outdoor colony is running short it should be given a comb of sealed stores. To avoid disturbing the winter nest this should be given directly on top of the brood-frames laid upon a couple of sticks. On top of the comb should be placed two other strips and then the packing-material. A comb may be given in the same way in the cellar, but it would be more practicable to take out an empty frame and put the one containing the stores in its place.

If one does not have any combs of honey he may give rock candy, provided it has not been scorched or burned, or any kind of bee candy.* See Candy. If the candy is the same as that used in queen-cages, or what is called Good candy, it should be put in shallow trays like paper or wooden pie-plates, so that, in case it becomes soft, it will not run down over the combs, thus daubing the bees, and ultimately destroying the colony. There is always danger that a soft candy may do this, and hence we advise a hard candy. For directions for making this candy, see Candy. But since the article in the fore part of this work was written, we have discovered that the use of a little honey makes a better candy. But do not use too much. One pound or a pound and a half of honey to 20 lbs. of sugar will be about the right proportion. Otherwise it is made as directed under Candy. It is very important that the mixture be not heated to a higher temperature than 280; and for this purpose a candy-thermometer should be used.

It is a nice art to make hard candy, and perhaps some would not care to undertake it. One or two reports seem to show that loaf sugar may be laid on top of the frames. In winter there would be enough dampness to keep the sugar moist. For summer feeding it would have to be dampened perhaps.

BEE-CELLARS VARIOUSLY CONSTRUCTED.

Having stated the general principles of cellar-wintering, we give views and descriptions of some of those used by men who are very successful in wintering.

Mr. N. D. West, of Middleburgh, N. Y., has been very successful in wintering bees in ordinary cellars under dwelling-houses. He prefers to have the bee-room separated from the outside door by another room, possibly a vegetable-room, so that the temperature may be controlled more easily. The door between the two rooms may be left open most of the time, although it can be closed when necessary. An outside ventilator is used through an opening in one of the windows. A wooden box is made 8 inches square and about 2 ft. long. This extends through the window, and the outer end is built up so that the whole ventilator assumes the form of an elbow. The outer opening, which may be about 3 ft. from the ground, is then covered in such a way as to keep out the rain and snow, but still allow space for foul or warm air to escape from the bee-room. Any openings that would admit light are closed so as to make the room dark and warm. Mr. West thinks it is advisable to have a spring of running water in one corner, if possible, that the temperature may be kept constant.

In placing his hives in the cellar, he does not take off the bottom-boards. He makes a platform about four inches above the cellar-floor, and puts one row of hives on this with the back ends resting on a 2 x 5, so that they are four inches higher than the front ends. The next row of hives is placed on top of this row, although set back just a little so that the tiers will not fall over. As will be seen, all the hives will be so placed with the entrances at least four inches lower than the back ends of the hives, so that any dead bees may be easily cleaned out. See illustration.

* I have become satisfied that a candy is safer than a syrup for *winter feeding*, especially by the novice. In fact, I am so sure of that and of its greater economy in material, in bee life, and manual labor, that I doubt if I ever again use much syrup. Soft sugar for stimulating, and candy for cold weather. Even though soft sugar be safe for winter it takes too much labor to adjust feeders and bees. An inverted feeder of candy on top is instantaneous and economical.—A. C. M.

Harry Lathrop, of Bridgeport, Wisconsin, uses a stone bee-cellar built in a side hill. There are two rooms in the cellar, or, more properly speaking, a main room for the bees and a smaller one used as a vestibule. He thinks that, in some cases, it is advisable to have a stove in the vestibule. If there is a small opening at the top of the vestibule leading into the bee-room, and another opening at the bottom, artificial heat will cause a circulation. The air can be kept fresh by opening the outside door at intervals. An oil-stove should not be used, ordinarily, for the resulting bad air will be worse for the bees than the cold.

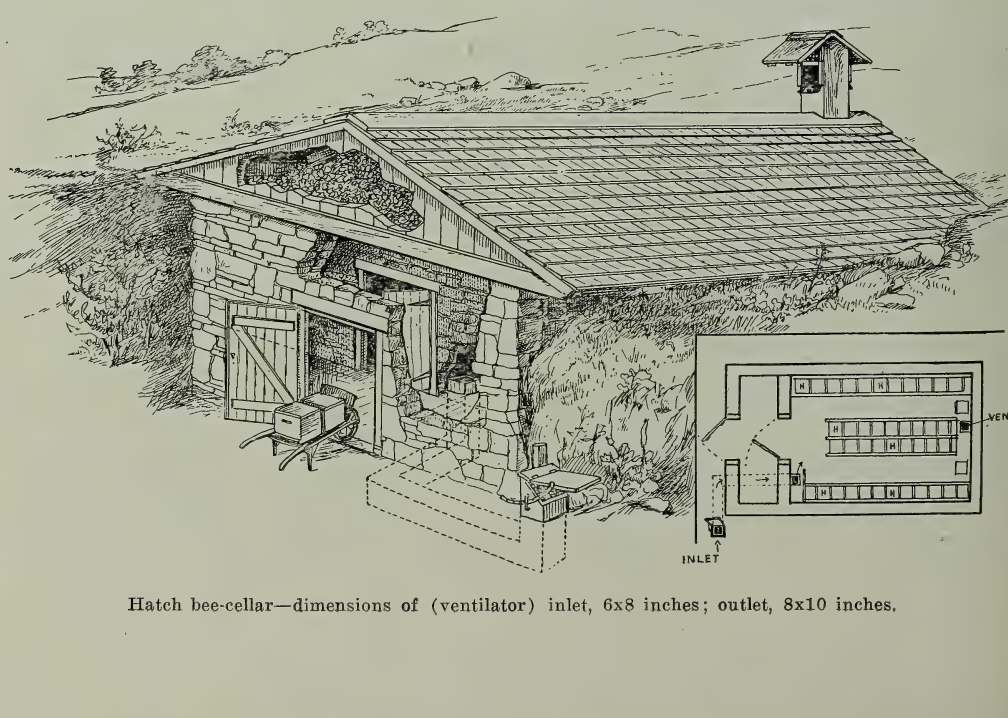
How N. D. West arranges his hives in the cellar.

With a properly constructed bee-cellar, there should be no need of artificial heat; but, nevertheless, it is best to have the cellar so arranged that a stove can be used if necessary.

The illustration given here at the bottom shows Mr. C. A. Hatch's plan for a bee-cellar. It will be seen that the bee-room is almost entirely under the ground. The space between the ceiling and the roof is filled with leaves.

Mr. Hatch thinks it is advisable to have a cellar near the apiary, and built in a side hill if possible. If the entrance is on the level it is very easy to wheel colonies in and out. He believes that a cellar 12 by 16 feet, inside measure, would be ample for 100 colonies in ten-frame hives, or for 120 colonies in eight-frame hives.

An important point connected with the Hatch bee-cellar is the double entrance, or vestibule. In this way the temperature can be regulated very easily. A temperature



Hatch bee-cellar—dimensions of (ventilator) inlet, 6x8 inches; outlet, 8x10 inches.

of 45 degrees Fahrenheit is considered ideal, but it is probable that a rise or drop of five degrees does no great harm unless continued more than 24 hours. Mr. Hatch agrees with Mr. France in thinking that the three essentials for safe wintering are good feed, proper temperature, and young bees.

HOLTERMANN'S BEE-CELLAR.

One of the largest bee-cellars, as well as one of the best designed, is owned by Mr. R. F. Holtermann, of Brantford, Ont., Canada, an extensive beekeeper of that province. The cellar is made wholly of concrete, and, what is of particular interest to beekeepers, has a scheme of ventilation that is almost ideal. It is not only theoretically perfect, but practically gives results in wintering that can scarcely be surpassed.

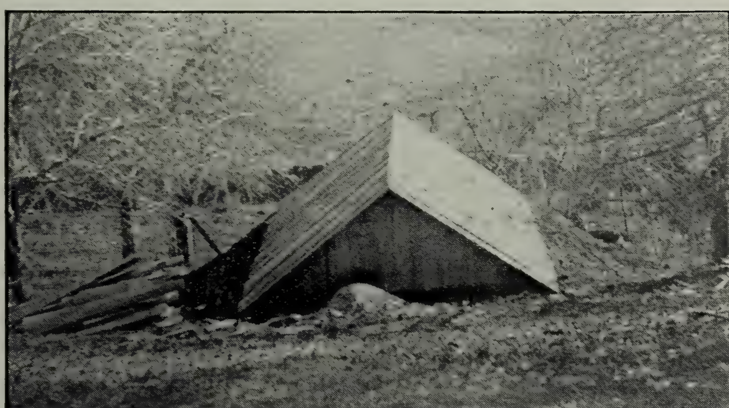
The authors have seen this cellar, and, notwithstanding there were about 500 powerful colonies in it at the time, there was perfect quiet and apparently perfect wintering. The temperature was about 43, and the air was pure and sweet. Scarcely any dead bees were found on the cellar bottom.

The bottom illustration on next page shows how his big twelve-frame colonies are piled up, having the ordinary entrance and a honey-board on top.

The sub-earth ventilator, in the diagram opposite, extends under the ground several hundred feet away from the building where it comes to the surface. At the other end it passes under the floor of the cellar, then up into a small room in which is placed a stove. From this compartment or room the air is distributed all around the cellar by means of a square wooden pipe suspended from the ceiling. Foul air is taken out at the bottom of the cellar by means of flues reaching down from the roof of the building to within a foot of the cellar floor. The upper story of the building is filled with hives and supers, being, in fact, the place where general shopwork connected with the yard is done.

Right here we can not do better than to give Mr. Holtermann's description.

Hull's bee-cellar, built in a side-hill; capacity 200 colonies.

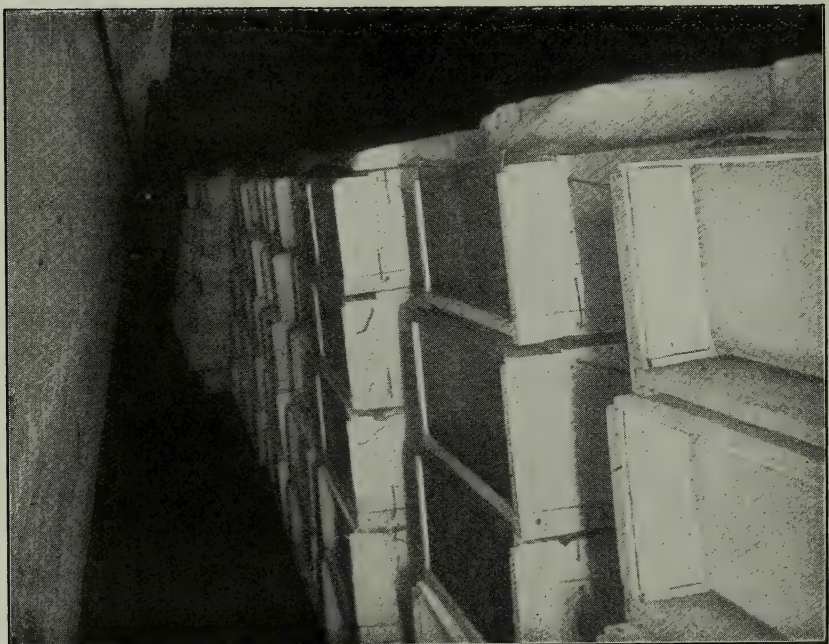


Rear view of Hull's bee-cellar.

DESCRIPTION OF THE CELLAR.

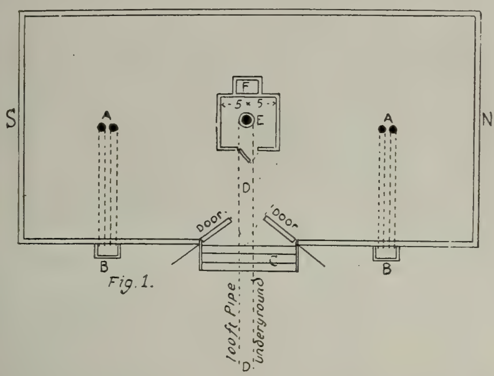
The bee-house is of concrete—even to the chimney. This has a cowl on top, which veers its back to the wind to assist in getting a draft. On each side of the chimney is a box ventilator projecting through the peak of the roof. This is 12 in. square, with a slide to regulate the amount of air passing

Holtermann's concrete bee-cellar and workshop.



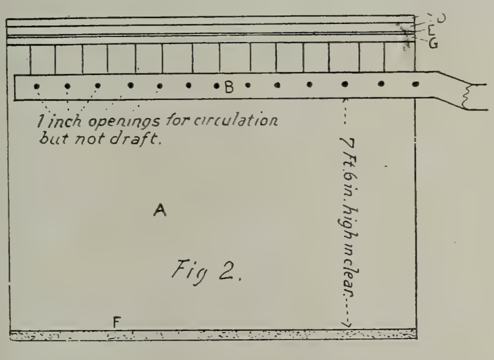
Interior view looking down the aisles of the Holtermann bee-cellar.

through. These shafts enter the cellar at the ceiling above, and are for warm weather. The building is 50 ft. long by 25 wide. The cellar walls are below the level of the ground, in order to get a more uniform temperature from the earth, and less liability for moisture to condense on its walls.



Ground plan of cellar. Inner compartment E has solid concrete walls extending to ceiling. Opening E communicates with a sub-earth ventilator, D. When in-rushing air is too cold a fire is built in the stove, tempering the air; then it passes upward to the ceiling, and into the square-box wooden flues shown at D D D D, in Fig. 3, where it is distributed to every point in the cellar.

The cellar-ceiling, to secure uniformity of temperature and prevent condensation, has, as seen in the perpendicular-elevation plan, Fig. 2, G, a tongue-and-groove floor; C, E, felt paper; D, air-space; C, tongue-and-groove floor; F, floor of the cellar, is concrete. The only openings from the outside into the cellar are seen in Fig. 1. From B to A are two glazed waterlime-jointed tiling, coming above ground just outside of the bee-house at B B, the wall going down 8 ft. into the ground; then passing under the cellar-wall and floor, en-

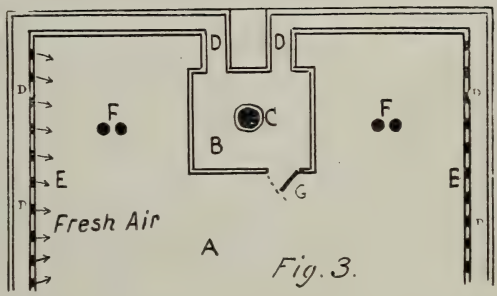


Perpendicular elevation of bee-cellar, showing the square-box ventilating-flue with its one-inch holes as shown in diagram 3.

tering the cellar at points A, A. Then there is a stairway, C, which is covered by two doors at the level of the ground, and again closed from the cellar by two doors. Through these doors the bees are brought in and out.

D is a 12-inch glazed pipe with waterlime joints 8 ft. under ground. This enters the cellar in the compartment E, a coal stove standing over this opening. In this compartment, if the air is not sufficiently tempered by its passage under the ground it can be warmed before it passes into the cellar.

In Fig. 3 the system of distributing fresh air is shown. The illustration is not quite correct as to the central compartment, however. B is supposed to be the same central compartment as E in Fig. 1, and the distance between it and the west wall should be greater. At the top of this compartment, on the west side, are pipes, D, D, D, which carry the fresh air to the north and south end of the cellar, E E respectively being the north and south ends. From there through many one-inch openings (see arrows also, in B, Fig. 2, and the method of turning the corner of the wall), the fresh air is evenly distributed through the cellar and carried off in a more or less foul condition through openings in the bottom of chimney F, in Fig. 1, and at ventilators, F F, in Fig. 3, said ventilators showing through the roof on either side of the chimney shown in the exterior half-tone view of the cellar.



Horizontal plan showing scheme of ventilation. Room B has solid concrete walls to prevent danger from fire from the stove at C. Under the stove is the sub-earth ventilator opening that supplies fresh air, which, if too cold, is warmed and then forced through the distributing-flues D D D D, which are perforated by one-inch holes. The flues D D are closed at the ends, and all air must pass out at the holes indicated by the arrows. F F are ventilators carrying foul air and moisture by means of flues extending through the roof.

I have a curtain this winter on the north, south, and west walls, and find it assists in equalizing the temperature. This winter I have had more or less air passing through all the air passages, yet have kept up a sufficiently high temperature half the time without fire.

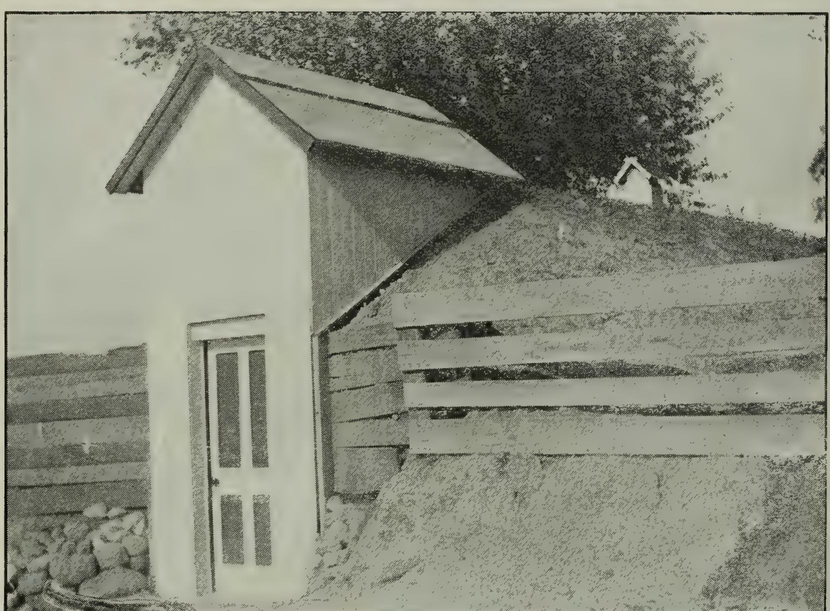
Two years ago I darkened all the windows in the bee-house above, and partially opened a trap-door which leads by means of a stairway alongside of the center compartment to the cellar floor. This, however, gave too rapid variations in temperature and was abandoned. During the last strong gale, with the wind reaching a velocity of over 60 miles an hour, within 24 hours a change from 59 to 12 degrees was experienced; while there was a variation of only 2½ degrees in the cellar without any alteration of the ventilating dampers.

Under the head of WINTERING IN TENEMENT HIVES, a few pages back, we have explained that Mr. R. F. Holtermann is not now using this bee-cellar. The reason for this is not because he could not winter successfully, but rather because he was away from home all winter. He was compelled to adopt a method that would permit him to put the bees into winter quarters in October, and leave them there without further attention until the following spring. See what he has to say on the subject a few pages back.

But in view of the fact that the Holtermann cellar is the most elaborate and best-appointed bee-cellar that was ever constructed in this country or Canada, we preserve its description with illustration because there are doubtless some who may be compelled to winter indoors where even the tenement plan of outdoor wintering would not be adequate to protect the bees from the severe cold that might prevail in the locality.

WINTERING BEES IN CLAMPS.

In parts of the country where the soil is sandy and porous, bees are often wintered in trenches dug in the ground. These are about 18 inches deep, large enough to hold two rows of ten hives each. The hives are set upon 2x4's to keep them off the ground. Three of these are used, one at each side and one in the middle, with the flat or wide side down. The bottoms are removed from the hives, and the covers raised half an inch or so to provide upward ventilation. About 18 inches of straw is thrown over the hives, and then the dirt is shoveled on. The engravings shown on next page illustrate the plan as practiced by E. D. Townsend, of Remus, Michigan. The first engraving shows the dirt partly shoveled away and some of the hives removed. The next illustration shows all of the hives removed in the spring from the pits or clamps, and set on their summer stands. It would seem as though there ought to be some provision made for ventilation; but when it is remembered that the soil is sandy and very porous, it is seen that this is not necessary. This plan can not be made use of in a location where the soil is composed largely of clay. Mr. Townsend thinks that it is well to have surface drains along each side of the pits to carry off any water that may come that way.



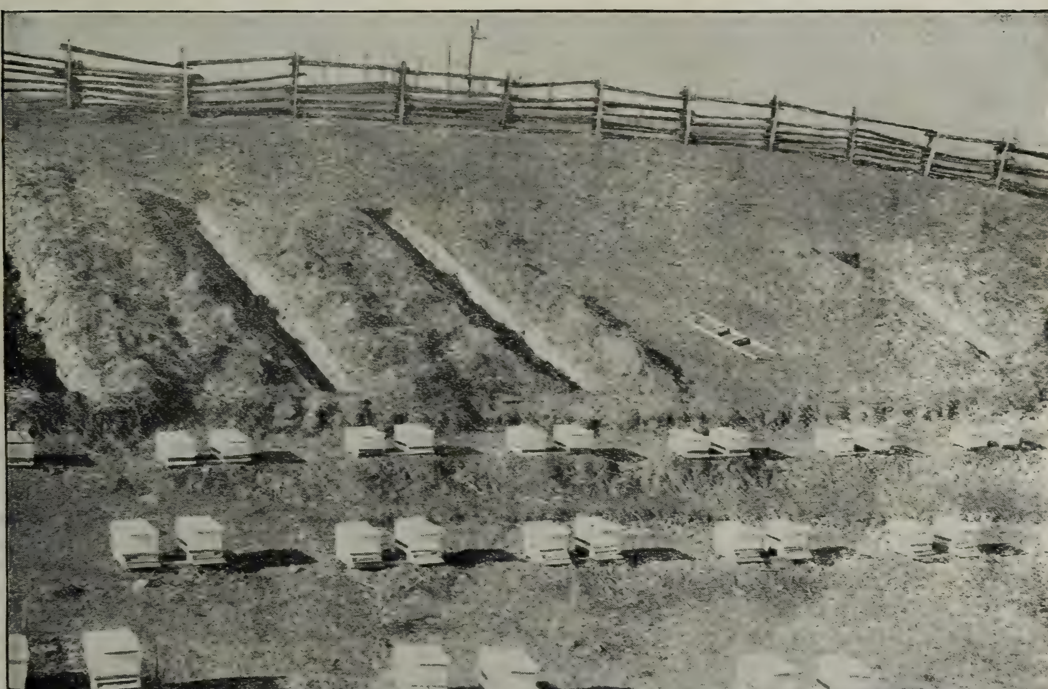
Davidson's concrete bee-cellar.

DO BEES HIBERNATE?

In the foregoing pages, under the general subject of WINTERING we have spoken of the quiescent state or sleep into which bees enter when the wintering conditions are ideal. In this period of semi-hibernation the bees seem merely to exist. With no activity the consumption of stores is very light. As the reader may wish to pursue this subject a little further we have thought best to take it up to help solve some of the wintering problems, and, perhaps, lead to some good results from an economic point of view.

Hibernation was exploited about 30 years ago, when it was generally decided, and rightly, too, that bees do not hibernate

Wintering colonies in clamps or trenches dug in the ground.—*From Beekeepers' Review.*



Colonies just removed from the trenches in the spring.—*From Beekeepers' Review.*

in the ordinary sense of the term (see *American Bee Journal* for 1885). But they do enter a quiescent state when the temperature has been lowered; and this state is somewhat analogous to the torpor experienced by some animals in a state of true hibernation, during which no food is taken, and respiration is considerably reduced. Dr. Marshall Hall has stated that "respiration is inversely as the degree of irritability of the muscular fiber." If the respiration is reduced without this irritability being increased, death results from asphyxia. Hibernation is usually induced by cold, and the animal under its influence attains nearly the temperature of the surrounding atmosphere, yet can not resist *any* amount of cold, although its capacity for doing so varies according to the animal. Some animals bury themselves in holes, like snakes and frogs; others, like the bear, crawl under a pile of leaves and brush where they are still further covered with snow. Thus buried they will go all winter without food or water; but there is a waste of tissue. Fish may be encased in ice and still live, it is said. A lively frog may be dropped into a pail of water four or five inches deep, and exposed to a freezing temperature. Indeed, there may be a thin coating of ice formed over the animal. The next morning, that frog, though stiff and cold, can be warmed up into activity, but to freeze solid will kill the creature.

Flies, as is well known, will secrete themselves in window-frames and other hiding places, subject to cold atmosphere, for weeks at a time, and yet revive on exposure to warmth. As is well known, also, ants have been repeatedly dug out of logs, frozen solid—in fact, fairly enveloped in frost; yet on exposure to warmth they will come to. Some hibernators can endure a freezing temperature, while others, like the bear, woodchuck, and the like, can not. Other very interesting incidents may be taken from natural history; but the purpose of this article is to consider whether bees go into a quiescent state that *approaches* hibernation, in which there is low respiration and a small consumption of stores.

Two or three years ago we put a number of cages of bees with some queens (laying the cages down on cakes of ice) in a refrigerator. The bees were chilled to absolute stiffness. Every day we would take out a cage, and each time the bees would revive, including the queen. This thing was continued for several days, and yet the bees would "come to" each time.

The strange part of it was, that the queens went on laying normally when put back in the hives, instead of laying drone eggs as we expected. Just what the temperature to which these bees were subjected was we can not say—probably something below 40 and something above 35, for the doors of the refrigerator were frequently opened, and the ice was constantly melting.

During one winter, when a very cold snap came on—the temperature going down to zero—we put out some cages of bees, exposing them to the cold wind, which was then blowing a pretty good gale, when the temperature was 5 above zero. We had expected that the bees possibly might be able to survive the shock for a number of hours, and yet revive; but 20 minutes of zero freezing was sufficient to kill them outright. If we had taken the bees and gradually acclimatized them to the cold, first subjecting them to 40, then to 35, and gradually down to the zero point, they would possibly have withstood the shock.

When the weather warmed up a little we took several cages of bees and buried them in the snow, leaving with them a thermometer so that we might know the absolute temperature. We went out and got a cage of bees about every two or three hours, and we found that we could revive them without difficulty; but at the end of 24 hours the bees, when they "came to," seemed somewhat the worse for the experience. The temperature in the snow played around the 32 mark. But the experiments conducted during the summer would seem to show that bees might stand a temperature of 38 for a number of days.

We know it to be a fact that the bees on the outside of the ball or cluster, in an out-door-wintered colony, will often be chilled stiff while those inside have almost a blood temperature. It has occurred to us that, during very severe weather, the outside bees may be gradually replaced by those within the cluster; for we know the bees are in constant movement.* Experi-

* And they are so replaced. They are far from being "chilled stiff." There is a constant movement from outside inward.—A. C. M.

ments show that a starved bee will not stand as much cold as one that is well filled. Beekeepers who have had any experience in wintering outdoors know how repeatedly they have taken clusters of bees that seemed to be frozen stiff, yet when warmed up before a good fire would revive and appear as lively as ever.

In view of the experiments we have thus far conducted, it would appear that bees might be able to stand a temperature of 40, or slightly below that, for a number of days; but if a warm spell does not come within a week, or less, those bees in their chilled condition may starve to death. But if it warms up, the cluster will unfold and the bees take food, and so be ready for another "freeze." The authors have repeatedly seen clusters of bees, after a zero spell, lasting a couple of weeks, that were stone dead; but the honey had been eaten from all around them within a radius of an inch or more. If a zero spell of weather continues more than a week or ten days, we always find some of the weaker colonies frozen to death in the spring.

There are some interesting phenomena in connection with chilled bees—their quiescent sleep, their low respiration, their light consumption of stores—that simulate a condition of semi-hibernation. The bees when in a chilled condition can go only a few days without food, while a bear, a true hibernator, may go all winter. When the temperature of a bee-cellar goes up to 50 or 60 the bees are active. Their respiration is normal. They must have ventilation, or die in large numbers. If we can maintain a temperature down to 45, with slight variation, there is a state of sleep where the respiration is very low, food consumption slight, and consequently not much fresh air is needed, or not more than what will percolate through the walls of the repository.

There is a practical side to this matter; for if we can induce semi-hibernation or torpor we cut down the consumption of stores.

WINTERING IN THE SOUTHERN STATES.—The directions so far given apply particularly to localities that are subject to zero weather at times, that have more or less of snow, and, during the greater portion of the year, a large amount of frost in the ground, extending down perhaps two feet.

Where bees can fly almost every day in the year, and for ten months are able to gather a little honey or pollen, outdoor wintering in single-walled hives is recommended. Double-walled hives would do no harm, and would, during the coldest of the weather, save considerable brood. The added expense for the extra walls and packing will be offset by the saving in brood and bees. While we recommend single hives for the southern portions of our country, and for some parts of the West, we always urge that the same be located in an inclosure of trees, a tight high board fence, a hedge, or any thing in the way of buildings that will break the prevailing winds. To establish windbreaks is one of the most important requisites in either the northern or southern portions of the country. See "Windbreaks" under APIARY.

While no great skill is needed to winter bees in such localities as are found in Florida, South Carolina, Texas, Louisiana, Georgia, Alabama, and Southern California, yet one must be careful to see that his bees do not run short of stores, as it seems to be a generally acknowledged fact that bees wintered in the South consume much more stores, according to the size of the colony, than in the North. Those in cold climates are compelled to contract into a very small ball for the purpose of concentrating the animal heat; and while in that condition they are in a semi-dormant state, and consume a comparatively small quantity of food. See "Do Bees Hibernate?" under WINTERING. On the other hand, bees in the South, especially in the warmest portions, can have access to all parts of the hive, rear more or less brood, and, as a consequence, when natural flora does not secrete nectar they are liable to run short of stores, and starve. To the Southlander let us urge that the greatest danger is starvation, and the next greatest is more or less of robbing during a dearth of honey. Indeed, all things considered, we believe Southern bees require more watching than those of the North.

In localities like Virginia, Tennessee, and other States lying in about the same latitude, it might be advisable to use double-walled hives; yet we know that the majority of beekeepers in that latitude

winter their bees successfully in single-walled hives; but we believe it is the general practice to place on top of the hive a super containing chaff, leaves, planer-shavings, or some good warm packing-material; moreover, when the colony is not very strong it is advisable to place a chaff division-board on each side of the cluster. In all cases there should not be given a larger cubic capacity than the bees can comfortably fill, spread out as they usually are on a day when the temperature is not below 70 F.

In Colorado it is customary to winter in single-walled hives. A shallow cap or tray containing a few inches of packing is placed on top of the hive. Very often, for further protection, a sort of shed or roof, with its back to the prevailing winds, is built over a row of hives. The Colorado beekeepers are troubled with sandstorms and fierce piercing winds; while the temperature may go down below zero, it is not likely to remain so for more than a few hours, when one extreme will change to a temperature of 60 or 70 F., and the bees flying. For such conditions double-walled hives and an excess of packing-material have been found to be not at all necessary.

WIRING FRAMES.—See Comb Foundation.

WOMEN AS BEEKEEPERS.—See Beekeeping for Women.

X Y Z

XYLOCOPA.—This is the scientific name of the genus to which the carpenter bees belong. Of course they do not gather honey, but we frequently receive large bees from readers who suppose they are some giant form of our own honey-bees. The largest and finest-looking bees in the world belong to the genus *Xylocopa*. There are possibly 10,000 species of bees in the world, of which only eight are regarded as *Apis*. The latter, though small and humble-looking, occupies the top of the class on account of its higher development.

YELLOW SWEET CLOVER. — See Sweet Clover.

ZINC, Perforated.—See Drones, Extracted Honey, and Swarming.

Beekeepers' Dictionary

Abdomen.—The hinder of the three parts into which a bee is divided.

Absconding Swarm.—A swarm which leaves for parts unknown.

Absorbents.—Materials more or less porous placed over the brood-chamber in winter, through which moisture may escape without much heat escaping.

Adair Frame.—13⅜ inches long, 11¼ inches deep.

After Swarms.—Swarms which come after the first swarm.

Albino.—A bee in which the coloring matter is deficient, making it lighter in color.

Alighting-board.—The projection before the entrance to a hive.

American Frame.—12 inches long, 12 inches deep.

Antenna (plural *antennae*).—Feeler; a horn-like appendage attached to the head of a bee; the organ of touch, and probably also of hearing and smell.

Anthers.—Tiny double bags containing pollen in the male parts of flowers.

Aphis.—A plant-louse which secretes honey-dew.

Apiarian.—Pertaining to bees or an apiary.

Apiarist.—A beekeeper.

Apiary.—A collection of colonies of bees; also the yard or place where bees are kept.

Apiculture.—Beekeeping.

Apidae.—The insect family to which bees belong.

Apis.—The genus to which honeybees belong.

Artificial Fecundation.—The impregnation of virgin queens in confinement (never accomplished).

Artificial Fertilization. — Fecundation of virgin queens in confined spaces (not correct term).

Artificial Pasturage.—Plants purposely cultivated for their nectar.

Artificial Pollen.—Rye meal, pea flour, or other substances fed as substitutes for the pollen of flowers.

Artificial Swarm.—A swarm made by dividing a colony of bees.

Automatic Hiver.—See *Self-hiver.*

Bacillus Larvae.—Cause of American foul brood.

Balling a Queen.—A number of bees clustering about a queen, sometimes making a ball an inch or more in diameter, sometimes releasing the queen unharmed; oftener continuing to ball her till she is dead.

Bar-frame.—A name sometimes applied to a movable frame in Great Britain.

Bee.—In classifying objects in nature, scientists are not all of a mind. For present purposes the following may suffice: There is first a division into the three kingdoms: Animal, vegetable, and mineral. Of course our bee belongs in the animal kingdom. That kingdom is divided into sub-kingdoms, and the bee is in the sub-kingdom *Annulosa* (ring-like). The sub-kingdom is separated into divisions, and the bee belongs in the division *Arthropoda* (jointed feet). The division is separated into classes, and the bee is found in class *Insecta* (cut into), also named *Hexapoda* (six-footed). The class is separated into orders, and the bee is found in order *Hymenoptera* (membranous-winged). The order is divided into families, and the family of the bee is *Apidae*. The family is divided into genera or genuses, and the genus of the bee is *Apis*. The genus is divided into species; and when we get down to species and the sub-divisions of species there is no little disagreement among the authorities, and the student is likely to get somewhat mixed up, especially as to using the words *race, breed, variety,* and perhaps others.

Of the genus *Apis*, Prof. Cook recognizes four species, *Indica, florea, dorsata,* and *mellifera.* The last species is the one that interests beekeepers especially, as it contains all the hive-bees and no others. It is also called *mellifica. Mellifica* means making honey and *mellifera* means carrying honey. The most appropriate term depends upon whether bees make or only carry honey. Certainly bees are honey-carriers; and since good ripe honey differs so much from the nectar that the bees find in flowers, it is hard to deny them the credit of being honey-makers. At any rate, most authorities seem to agree on *mellifica.*

This species Prof. Cook divides into the following races: *Nigra* (German bee), *fasciata* (Egyptian bee), *unicolor* (Madagascar), Adonsoni (African). Following the Egyptian bee he gives Syrian, South Palestine, Cyprian, Italian, Greek, Banat, Caucasian, with a question-mark after each.

He divides *A. mellifica nigra* into 8 varieties—Carniolan, or Krainer; Heath, Hungarian, Dalmatian, Herzegovinian, Smyrnian, Tunisian, and common black.

Bee-bread.—The pollen of flowers gathered by the bees, mixed with a little honey, and deposited in the comb.

Bee-brush.—A brush used in removing bees off their combs.

Bee Culture.—The care of bees.

Bee-dress.—A suit or dress to wear while working with bees, preventing stings.

Bee Escape.—A device to get bees out of supers or buildings, so constructed as to allow bees to pass through in one direction, but prevent their return.

Bee-gloves.—Gloves worn to protect the hands from stings and from propolis.

Bee-glue.—Propolis, which see.

Bee-gum.—An old-fashioned name, now almost obsolete, to indicate a colony and the hive.

Beehive.—A box or other contrivance for holding a colony of bees.

Bee-house.—A house constructed to contain colonies of bees.

Bee-line.—The shortest distance between two points.

Bee-louse.—A commensal parasite common in Europe, and practically unknown in America; *Braula coeca.*

Bee Metamorphoses.—The bee passes through three stages before becoming a perfect insect—first the egg, then the larva, and next the nymph. The following will serve to show how this is accomplished:

	Queen, days.	Worker, days.	Drone, days.
Incubation of the egg.....	3	3	3
Time of feeding the larva..	5	5	6
Larva spinning cocoons....	1	2	3
Resting period...........	2	3	4
Passing from larva to nymph	1	1	1
Time in the nymph state...	3	7	7
Total period of growth..	15	21	24
Hatching takes place on...	4	4	4
Cell sealed..............	9	9	9
Bee leaves its cell.........	16	22	25
Bee flies................	21	38	38

Bee-moth.—A moth whose larvæ destroy honey-combs, eating the wax; a wax-moth.

Bee Paralysis.—A disease of adult bees in which the wings have a trembling motion, and the bees

have a shiny appearance; of little account in the North, but sometimes severe in the South.

Bee-pasturage.—Flowering plants from which bees gather nectar.

Bee-pest.—Foul brood.

Bee Plants.—Flowering plants which produce nectar for bees.

Bee-space.—A space in which bees put the least amount of wax or propolis—about ¼ of an inch or a trifle more.

Beeswax.—The wax of which bees make their combs; excreted in small scales from the abdominal rings.

Bee-tent.—Tent of wire cloth or netting large enough to contain a hive and the operator, in which bees may be manipulated without being troubled by robbers.

Bee-tree.—A hollow tree occupied by a colony of wild bees.

Bee-veil.—A net veil for protecting the head from the attacks of bees.

Beeway Sections.—Sections having insets at the edges so as to make passages for the bees when the sections are crowded close together.

Black Bee.—The German or brown bee; the bee first introduced into this country.

Blastoderm.—The germ from which the embryo of the bee is developed.

Bottom-board.—The floor of a beehive.

Box Hive.—A plain box used for housing a colony of bees.

Box Honey.—Honey stored in small boxes.

Brace-comb.—The terms "brace-comb" and "burr-comb" are often used indiscriminately as meaning the same thing. More exactly, a brace-comb is a bit of comb built between two combs to fasten them together, or between a comb and adjacent wood, or between two wooden parts, as between two top-bars; while a burr-comb is a bit of wax built upon a comb or upon a wooden part in a hive, seeming to have no object but to use up wax.

Brimstoning.—The operation of killing a colony of bees with sulphur fumes.

British Standard Frame.—A frame 14 inches long by 8½ deep.

Brood.—Young bees not yet emerged from their cells.

Brood-chamber.—That part of the hive in which the brood is reared.

Brood-comb.—One of the combs in the brood-chamber.

Brood-nest.—That part of the brood-chamber occupied by eggs and brood. The term is also used to apply to that part where the bees are clustered when they have no eggs or brood.

Brood-rearing.—Raising bees from the egg.

Brushed Swarm.—An artificial swarm made by brushing or shaking part or all of the bees of a colony into an empty hive, thus anticipating and preventing a natural swarm. It is also called "shaken swarm" and "shook swarm," although some object to "shook swarm" as being ungrammatical.

Buckwheat-swarm.—A swarm issuing as late as the blooming of buckwheat.

Bumblebee.—A large hairy social bee, especially of the genus *Bombus;* humblebee.

Burr-comb.—See brace-comb.

Button or Bouton.—The enlarged part at the tip of a bee's tongue.

Candied Honey.—Honey that has granulated and become solid.

Cap.—1. The covering of a cell containing brood or honey; the capping; the sealing. 2. To cover a cell with a capping; to seal. 3. A hive cover.

Capped Brood.—Brood sealed over by the bees 8 or 9 days after the egg is laid; sealed brood.

Carniolan Bees.—Bees obtained from Carniola, Austria. They resemble black bees with somewhat distinct whitish bands.

Carton.—A pasteboard box for holding a section of honey.

Cashier.—To destroy a colony of bees or unite it with another colony.

Cast.—A second swarm; also applied to any swarm after the first.

Cell.—One of the hexagonal compartments of a honey-comb.

Cell-cup.—A queen-cell when it is only about as deep as it is wide. Artificial cell-cups are made as well as natural.

Cell-protector—A receptacle made of wire cloth, which protects the sides of a queen-cell from the attacks of bees, but leaves the apex of the cell open.

Chaff Hive.—A hive having double walls filled between with chaff.

Chorion.—The reticulated membrane or network that covers a bee-egg.

Chrysalis.—See pupa, the more usual name.

Chyle.—A milky substance prepared in the chyle-stomach of the nurse-bees, and fed to a young queen during its whole larval existence, and to other larvæ during their first three days of feeding.

Chyme.—Partially digested food to be further elaborated into chyle.

Clamp.—A winter repository for bees, made in sandy soil by digging a trench in which the hives are placed, and then covered with straw and earth.

Claustral Hive.—Having a covered-in entrance with ventilator for winter. See Cloister hive.

Cleansing Flight.—The flight of the bees from the hive after long confinement, as in the spring, when they void their feces in the air.

Cloister Hive.—A hive provided with a cloistered entrance, which excludes the light in winter weather to prevent the bees from flying.

Closed-end Frames.—Frames with end-bars so wide that no space is left between them.

Cold Arrangement.—When frames run at right angles to the entrance it is called the cold arrangement; when they run parallel with the entrance it is called the warm arrangement. In Europe the warm arrangement is quite common, but in America the cold arrangement prevails almost exclusively.

Colony.—A community of bees having a queen, some thousands of workers, and during part of the year a number of drones; the bees that live together as one family in a hive.

Comb.—An assemblage of hexagonal cells made of wax to contain eggs, brood, honey, or pollen; honey-comb.

Comb-basket.—That part of a honey-extractor in which the combs are held.

Comb-carrier.—A receptacle in which one or more combs may be placed and covered, so as to be easily carried, and protected from robbers.

Comb Foundation.—Thin sheets of beeswax stamped to imitate comb, forming a base on which the bees will construct a complete comb.

Comb-foundation Machine.—A machine for stamping the foregoing.

Comb-guide.—Strips of wood used as a guide in the construction of combs.

Comb Honey.—Honey in comb together with the comb.

Cross.—When races of bees are bred together the resulting progeny is called a cross.

Cyprian Bee.—The native bee of the island of Cyprus.

Danzenbaker Frame.—17 inches long, 7½ inches deep.

Decoy Hive.—A hive placed with the object of attracting passing swarms.

Dequeen.—To take the queen from a colony of bees; to unqueen.

Dividing.—Separating a colony in a manner to produce two or more colonies.

Division-board.—A thin board of the same size as the inside length and width of the hive, used to contract the size of the brood-chamber or to divide it into separate compartments.

Dovetailed Hive.—A hive with Langstroth frames, the hive having interlocked corners after the manner of dovetailing.

Drone.—Male bee.

Drone Brood.—Brood which matures into drones, bred in larger cells than worker bees.

Drone Comb.—Comb having cells which measure 4 to the inch. Drones are reared in drone comb; also honey is stored in it, but not often pollen. Drone comb is about one inch thick when used for brood; when used for honey it may be very much thicker. Drone comb has about 18½ cells to the square inch on each side.

Drone Egg.—The egg from which a drone hatches—an unimpregnated egg.

Drone-trap, see *Queen-trap*.

Drumming.—Pounding on the sides of an inverted hive to make the bees ascend into another hive placed over. In England it is called "driving."

Dummy.—A thin board of the same size as a frame, or a little smaller, having a top-bar nailed on top. A dummy differs from a division-board in that it allows the free passage of bees on all sides, while a division-board prevents their passage.

Dysentery.—When bees can not fly, and an accumulation in the intestines causes them to discharge watery feces in the hive or on the outside-front of the hive, they are said to have the dysentery or diarrhea.

Dzierzon Theory.—A set of 13 propositions put forth by Rev. John Dzierzon (pronounced Tseer tsone) in the middle of the 19th century, propounding the then novel idea of parthenogenesis.

Egyptian Bee.—Apis fasciata. A smaller and more beautiful bee than the Italian, but exceedingly cross.

Embryo.—The germ of the bee in the egg.

Entrance.—The opening at the front of a hive to allow the bees to pass out and in. In America the entrance is almost universally at the bottom of the hive. In Europe it is often higher up.

Entrance Blocks.—Three-cornered pieces of wood for regulating the size of the entrance.

Excluder, see *Queen-excluder*.

Extracted Honey.—Honey obtained from combs by means of a centrifugal extractor.

Extractor.—See Honey-extractor and Wax-extractor.

Extra-thin-super Foundation. — Comb foundation running about 13½ square feet to the pound.

Fdn.—An abbreviation for the words *comb foundation.*

Feces.—Excreta of bees.

Fecundate.—The queen is fecundated upon meeting the drone, and is then capable of laying eggs that will produce workers or queen; to fertilize; to impregnate.

Feeders.—Appliances for feeding bees artificially.

Femur.—Thigh of the honeybee.

Fence.—A slotted separator resembling an ordinary wooden fence. It is used as a guide to compel the bees to build combs that are straight.

Fertile.—A fertile queen is one that has mated with a drone.

Fertilize.—A queen's eggs that are intended to produce workers or queens are fertilized on their outward passage by receiving one or more of the spermatozoa contained in the spermatheca of the queen. Drone eggs are unfertilized.

Field Bees.—When worker bees become about 16 days old, they begin the work of flying abroad to collect nectar, pollen, water, and propolis, and are then called field bees.

Fielders.—Field bees.

Fixed Frames.—Frames that do not hang loose in the hive, but touch at one or more parts of the end-bars; self-spacing frames.

Formic Acid.—A colorless corrosive liquid compound (HCO.OH), forming a very small but important part of honey.

Foul Brood.—A malignant contagious disease of bees affecting the brood.

Foundation.—See Comb Foundation.

Foundation Splints.—Wooden splints about 1-16 inch square, embedded vertically in the foundation of a brood-frame to prevent sagging.

Frame.—Four slats of wood to hold a comb, invented by the late Rev. L. L. Langstroth, of Oxford, Ohio. This frame requires a bee space ¼ of an inch on all sides to be effective. Can be moved in any direction.

Fumigate.—To submit to the fumes of sulphur, carbon bisulphide, or other disinfectant. Combs are fumigated to kill the eggs or larvæ of the bee-moth, and bees are sometimes killed by fumigation.

Galleria Mellonella (formerly *Galleria Cereana.*)—The scientific name of the wax-moth.

Ganglion (plural, *ganglia*).—A nodular enlargement consisting of an aggregation of nerve-cells that receives and sends forth nervous impulses and serves to stimulate organic and psychical action; a nerve center.

Go-backs.—Unfinished sections which are returned to the hive to be finished.

Golden Bees, or *Goldens.*—Bees in which the workers show as many as five yellow bands.

Good Candy, see *Queen Candy*.

Grafting.—Applied by beekeepers to the process of removing a worker larva from its cell into a queen-cup, with the view of having it reared into a queen.

Green Honey.—Unripe honey.

Hatching Brood.—Young bees just gnawing their way out of the cells.

Heddon Frame.—5⅜ inches deep by 18 1-16 in length.

Hive.—1. A home for bees furnished by man; 2. To put a swarm in a hive or to induce it to enter a hive.

Hive-tool.—A tool used to pry up supers, pry frames apart, etc.

Holy Land Bees.—A variety of bees from Palestine. Somewhat resemble Italian bees, but are more irritable.

Honey.—The nectar of flowers gathered by the bees, and so changed by them that it becomes honey. According to the national pure-food law, "Honey is lævo-rotatory, contains not more than 25 per cent of water, not more than 25 per cent of ash, and not more than 8 per cent sucrose (cane sugar.)"

Honeybee.—Apis mellifica.

Honey-board.—A slatted board placed between the brood-chamber and the honey-chamber to break the continuity of the two; formerly a board with holes in it to support the receptacles of comb honey. A queen-excluder is sometimes called a honey-board.

Honey Box.—A box for comb honey, closed on all sides, and provided with holes to allow the bees access. Almost obsolete.

Honey-comb.—Two series of waxen cells with a septum between them, which septum serves as the bottom for the cells of both series. In the Bible honey-comb means comb honey. See Drone Comb and Worker Comb.

Honey-dew.—A sweet liquid similar to the nectar of flowers deposited on the leaves and branches of plants. It is of two kinds. One is the production of plant lice, and the other exudes from around the axils of leaves and flowers.

Honey Evaporator.—A machine for removing water from honey deemed too thin.

Honey Extractor.—A machine for throwing the honey from combs by centrifugal force.

Honey Gate.—An iron faucet used for drawing honey from barrels or other receptacles.

Honey-harvest.—1. Surplus honey taken from bees. 2. The time when bees are gathering a surplus, or more than enough for their daily needs.

Honey-house.—A building for the purpose of honey extraction, storage, etc.

Honey-knife.—A knife used to shave the cappings from combs of sealed honey preparatory to extracting.

Honey-sac.—An enlargement of the bee's esophagus after it enters the abdomen; the sac in which a

bee carries nectar or honey; honey-bag; honey-stomach.

House Apiary.—1. An apiary kept in a specially constructed building; 2. The building itself which contains the hives, the walls of the building containing holes through which the bees pass out and in.

Hybrids.—Usually used by beekeepers to designate a cross between the common black bee and the Italian.

Hymettus.—A mountain district of Greece famous for its wild-thyme honey, and celebrated in classic poetry and history.

Imago.—The fully developed bee or other insect.

Introduce.—To give a colony a strange queen, taking precautions so that she will not be killed by the bees.

Introducing.—The manner in which a strange queen may be introduced to a colony of bees in the stead of a former one to which they were accustomed. It is usually performed by hanging the queen in a cage in the midst of the strange bees several days until she acquires the odor of the hive.

Introducing Cage.—A small box of wire and wood.

Inversion.—The process of turning a hive upside down to compel the bees to attach their combs to the bottom-bar, also to remove honey from brood frames into the supers.

Italian Bee.—The native bee of Italy, the workers having three yellow bands. In America it has been bred to have four or five yellow bands.

Italianize.—To change a colony of any other race to Italians by introducing an Italian queen.

Jumbo Frame.—17⅝ inches long, 11¼ inches in depth.

Lamp Nursery.—A kind of hot-water incubator for bees where queens are placed till wanted.

Langstroth Frame.—17⅝ inches long by 9⅛ inches deep.

Langstroth Hive.—A hive having frames 17⅝ by 9⅛. In one sense, any movable-frame hive is a Langstroth hive, since Langstroth invented the movable-frame hive.

Larva (plural *Larvae*).—A bee in the worm state; unsealed brood.

L. Frame.—Langstroth frame.

L. Hive.—Langstroth hive.

Laying Worker.—A worker which lays eggs, such eggs producing only drones.

Light Brood Foundation.—Comb foundation running about 9 square feet to the pound.

Ligurian Bee.—Italian bee, named for the district in which the best Italian bees are found.

Lining Bees.—Watching the direction of the flight of bees so as to trace them to their home (usually in some hollow tree).

Loose Frames or *Loose-hanging Frames.*—As opposed to fixed frames, those which have no provision for self-spacing, but must be spaced by the eye.

Mal-de-mai.—May-sickness; a peculiar disease of bees occurring mostly in May, and giving much trouble in Europe.

Mandibles.—The jaws of the bee working like a pair of pliers, but sidewise, not up and down, as with ourselves.

May-pest.—Same as Mal-de-mai.

Medium Brood Foundation.—Comb foundation running about 7 square feet to the pound.

Melipona Bees.—A genus of stingless bee inhabiting South and Central America, comprising at least 50 species, some domesticated.

Mel-extractor.—Honey-extractor.

Metal Corner.—A metal attachment fastened to an upper corner of a brood-frame, making a very small point of contact with the support, thus making less trouble with propolis.

Movable Frame.—A loose comb frame which can be removed completely from the hive for the purpose of examination or use. A Langstroth frame.

Natural Swarm.—A swarm of bees issuing spontaneously from the mother hive.

Nectar.—The sweet exudation secreted by glands in different parts of plants, chiefly in the flowers.

Nectaries.—The parts of a flower wherein is secreted the nectar.

Neuter.—A name sometimes applied to worker bees.

Non-swarming Hive.—A hive so constructed as to control the desire to swarm.

Nucleus (plural *Nuclei*).—A very small colony of bees. The difference between a nucleus and a colony is much like the difference between a boy and a man. It is not easy to say just when a nucleus becomes large enough to be called a colony. Perhaps nothing larger than three combs with adhering bees should be called a nucleus, although in the spring many called colonies have much less than three frames of brood.

Nurse Bees.—The worker bees that feed the young, and do other work inside the hive. They are generally less than 16 days old.

Observatory Hive.—A hive largely of glass to allow of the bees being observed at work.

Ocelli.—The three simple eyes of the bee.

Out-apiary.—An apiary kept at some distance (generally more than a mile) from the home of the beekeeper.

Overstocking.—A condition reached when there are too many bees for a given locality.

Paraffine.—A white translucent substance somewhat resembling beeswax, derived from mineral oil, and sold very largely in the form of candles. It is used by beekeepers to render honey-barrels tight.

Parent Stock.—The mother of a swarm.

Parthenogenesis.—Production of a new individual from a virgin female without intervention of a male; reproduction by means of unfertilized eggs. In bees the unfertilized eggs produce only males. An unfecundated queen, and sometimes a worker, may lay eggs that will hatch, producing only drones.

Perforated Zinc.—Zinc sheet metal having oblong holes 1-6 of an inch in width to allow worker bees alone to pass, and excluding queens and drones.

Pickled Brood.—Dead brood that has a sour smell. It may be dead from disease, or from cold or starvation.

Piping.—A series of sounds made by a queen, louder than any sound made by a worker, consisting of a loud, shrill tone, succeeded by several others, each sound shorter than the one that precedes it. A laying queen is seldom heard to pipe; a virgin perhaps always pipes at intervals after emerging from her cell, and in response to her piping may be heard the *quahking* of one or several virgins in their cells, if such are in the hive, the quahking being uttered in a lower key and in a more hurried manner than the piping. Piping is also called "teeting."

Pistil.—The female organs of a flower collectively.

Plain Sections.—Comb-honey sections with no insets or scalloped edges.

Pollen.—The fecundating element in flowers gathered by the bees in the form of a sticky flour kneaded into pellets deposited on their legs.

Pollen Basket.—A cavity on the hind legs of the bee wherein is deposited the pollen gathered from flowers.

Prime Swarm.—The first swarm—the swarm with the old queen.

Propolis.—A kind of glue or resin collected by the bees and chiefly used to close up cracks and small spaces.

Pupa.—The third stage of the bee, during which it is inactive and sealed up in its cell; sometimes called "chrysalis."

Quahking.—The noise made by a young queen in her cell in response to the piping of the queen at large. See Piping.

Queen.—A fully developed female bee; the mother bee.

Queen Cage.—A small box of wire and wood in which queens are held prisoners.

Queen Candy.—Candy made by kneading powdered sugar into extracted honey until it forms a stiff

dough; used in queen-cages; called Scholtz candy, because Rev. M. Scholtz introduced it in Europe. Afterward I. R. Good gave it prominence in America, and so it is often called Good candy.

Queen-cell.—A cell in which a queen is reared, having an inside diameter of about 1-3 of an inch, hanging downward an inch or more in length.

Queen-excluder.—A device consisting wholly or in part of sheet-zinc having oblong perforations about 1-6 of an inch wide, allowing workers to pass through but excluding queens and drones.

Queening.—The act of introducing a queen into a queenless colony of bees.

Queenless.—Having no queen.

Queen-nursery.—A cage or set of cages in which to confine queen-cells or queens.

Queen-rearing.—Raising queens.

Queen-register.—A card to be attached to a hive with pointers that may be moved so as to indicate dates, and conditions relating to the queen, such as *cell, hatched, laying*, etc.

Queenright.—Having a good laying queen.

Queen's Voice.—A sound made by a queen. See Piping.

Queen-trap.—A device provided with perforated zinc, to be attached to the entrance of a hive, allowing workers to pass, but trapping any queen or drone that attempts to issue. Called also *Drone-trap.*

Quilt.—A cover for brood frames made in the form of a thin cushion.

Quinby Frame.—The hanging Quinby frame is 18½ by 11¼; the closed-end or standing Quinby is 19⅛ by 11, is without lugs, and supported at the bottom.

Quinby Hive.—A hive invented by Mr. Quinby based on Huber's leaf hive of the latter part of the 18th century.

Quincunx.—An arrangement in which hives are placed in equilateral triangles, and so in straight rows in three directions, allowing a large number on a given space. The cells of honeycomb are in quincunx order.

Rabbet.—Usually has reference to a narrow piece of tin folded in a peculiar manner to form a rest for the shoulders of the hanging frames.

Race.—The kinds of bees into which the species *Apis mellifica* is divided, the race being usually named after the place of nativity, as Italian, German, Carniolan. Sometimes the word *variety* or *breed* is used with the same meaning.

Rendering Wax.—The process of melting combs and refining wax from its impurities, usually done by means of hot water or steam accompanied by pressure on the mass of material.

Repository.—A room, usually upon a hillside, partly or wholly below ground, in which bees are wintered; a bee-cave; a bee-cellar. In a general sense the word may be used for any place in which bees are wintered.

Reversing.—Turning over or inverting a hive with bees to accomplish certain results.

Ripe Honey.—Honey left in the care of the bees until it contains less than 25 per cent of water.

Robbing.—As applied to bees, the taking of honey by stealth or force from the hives of other colonies.

Royal Cell.—Queen-cell.

Royal Jelly.—A rich food of whitish appearance placed by the nurse bees in queen-cells as food for the royal larvæ.

Scholtz Candy, see *Queen Candy.*

Sealed Brood.—Brood that has been capped or sealed over by the bees with a somewhat porous capping; mostly in the pupa stage.

Section.—A small frame or box open on two opposite sides, that is placed on a hive to receive surplus honey; a section box. Also, the honey contained in a section box.

Section Box.—A sectionally constructed box for containing a small honeycomb.

Section Holder.—A device for holding sections while in process of being filled on the hive.

Self-hiver.—Any device by which the bees of a swarm are induced to enter of their own accord a hive prepared for them.

Self-spacing Frames.—Frames so made that, pushed together, they will be spaced the proper distance apart from center to center (usually 1⅜ inches); fixed frames.

Separator.—A very thin board or sheet of tin placed between sections to make sure that the bees will build the combs accurately.

Septum.—The middle of a honey-comb.

Shaken Swarm or Shook Swarm.—An artificial swarm made by shaking bees from a very populous colony into a fresh hive. By this means natural swarming is closely imitated. See Brushed Swarm.

Sheet.—A piece of enameled cloth or other cloth placed over a brood-chamber or super to preserve the heat and to keep the bees down.

Shipping Case.—A light box, usually with glass on one side, of varying size, in which section honey may be shipped. The sizes most commonly in use are those containing 12 and 24 sections each.

Skep.—A bee-hive without movable frames, especially one made of straw.

Skeppist.—An old-fashioned beekeeper.

Slumgum.—The refuse from a wax-extractor.

Smoker.—An implement having a fire-box with bellows attached, by means of which smoke may be blown upon bees; a bee-smoker.

Solar Wax Extractor.—A glass-covered box melting beeswax by the heat of the sun.

Sour Brood.—Pickled brood, which see.

Spermatheca.—A small sac attached to the oviduct of the queen, in which is stored the spermatozoa received from the drone in the act of copulation.

Spermatozoon.—One of the germs contained in the semen of drones. (Plural, spermatozoa.)

Spiracles. — Air-tubes through which the bee breathes.

Spreading Brood.—Putting a comb without brood between two combs of brood to induce the queen to lay in the former.

Stamens.—Male organ of flowers producing pollen.

Starter.—A small piece of comb or foundation fastened in a frame or section to start the bees to building at the right place.

Stigma.—That part of the pistil of a flower which receives the pollen for the fecundation of the ovules; usually the end of the pistil.

Strain.—Although scientists may not all agree as to using this word, John Phin, in his excellent Dictionary of Practical Apiculture, says it "is one of the most useful, expressive, and legitimate words that we have, and this is shown by the extraordinary difficulty of finding a synonym for it." Suppose one has a certain race of bees. Among them he finds some that are specially noted for some particular quality, good or bad, as gentleness or viciousness, and this quality descends with more or less certainty to their posterity. This quality does not differentiate them from others of the same race sufficiently to constitute them a different race or breed, but it is of sufficient importance to warrant their being called a strain. Moreover, the characteristics of a strain are not so fixed as the characteristics of a race, and without great care the particular characteristics will disappear, or, as we say, "the strain runs out."

Super.—A receptacle in which bees store surplus honey; so called because placed *over* the hive.

Supersede.—When said of bees, to rear a young queen to take the place of the old one at other than swarming time.

Surplus or *Surplus Honey.*—Honey over and above what the bees need for their own use, and which the beekeeper takes from them; honey stored elsewhere than in the brood-combs.

Surplus Apartment.—The apartment in which surplus honey is stored.

Swarm.—A large number of bees with a queen leaving the mother colony to find new lodgings and found a new colony.

Swarm-catcher.—A net placed at the entrance of a hive, a basket at the end of a pole, or any other device intended to secure a swarm as it leaves the hive or afterward.

Swarming Season.—The period of the year when swarms usually issue in numbers.

Syrian Bees, Holy Land bees, which see.

Tarsus.—The foot of a bee.

Tested Queen.—A queen whose progeny show she has mated with a drone of her own race.

Thin-super Foundation.—Comb foundation running about 12 square feet to the pound.

Thorax.—The middle part of a bee between the head and abdomen, and to which the wings and legs are attached.

Tiering Up.—Adding supers on the top of a hive.

Transferring.—Ordinarily applied to the process of changing bees and combs from common boxes to movable-frame hives.

Transformations, see *Bee Metamorphosis.*

Transposition Process.—Taking a young larva from a worker-cell and placing it in a queen-cell cup.

Travel-stain.—The darkened appearance upon the surface of comb honey when left long upon the hive; so called because it was formerly supposed it was caused by the bees traveling over the comb.

Trigona Bees.—A genus of stingless bees in South America and Asia. Some species bite furiously.

Uncapping-knife, see *Honey-knife.*

Unqueening.—Removing the queen of a colony of bees.

Unripe Honey.—Honey which has not been left in the care of bees long enough to be thickened until it contains less than 25 per cent of water.

Unsealed Brood.—Brood not yet sealed over by the bees. In a general way eggs are often included with larvae under the term *unsealed brood.*

Virgin Comb.—Comb which has been used for honey only once, and never for brood.

Virgin Queen.—An unfecundated queen.

Warm Arrangement, see *Cold Arrangement.*

Wax-extractor.—An appliance for rendering wax by heat, or by heat and pressure.

Wax Pocket.—The receptacles on the under side of the abdomen wherein the bees secrete their wax.

Wax-press.—A press in which the wax is squeezed out of the heated combs.

Wean.—To cease giving the highly concentrated food that is first fed to larvæ, and to give coarser food. A worker larva is weaned when three days old.

Wedding-excursion or *Wedding-flight.*—The flight of the queen when five days old or older, to mate with the drone in the air.

Wild Bees.—Bees that are living in hollow trees or other abodes not prepared for them by man. Strictly speaking, they are no wilder than bees in hives.

Wild Queen-cells.—When queen-cells are being reared, those which are started on combs where they are not wanted are called *wild.*

Windbreaks.—Either specially constructed fences or barriers composed of growing trees to reduce the force of the wind.

Wintering.—The care of bees during winter.

Worker.—A female bee whose organs of reproduction are undeveloped; well named "worker," because workers do all the work of the colony except laying the eggs.

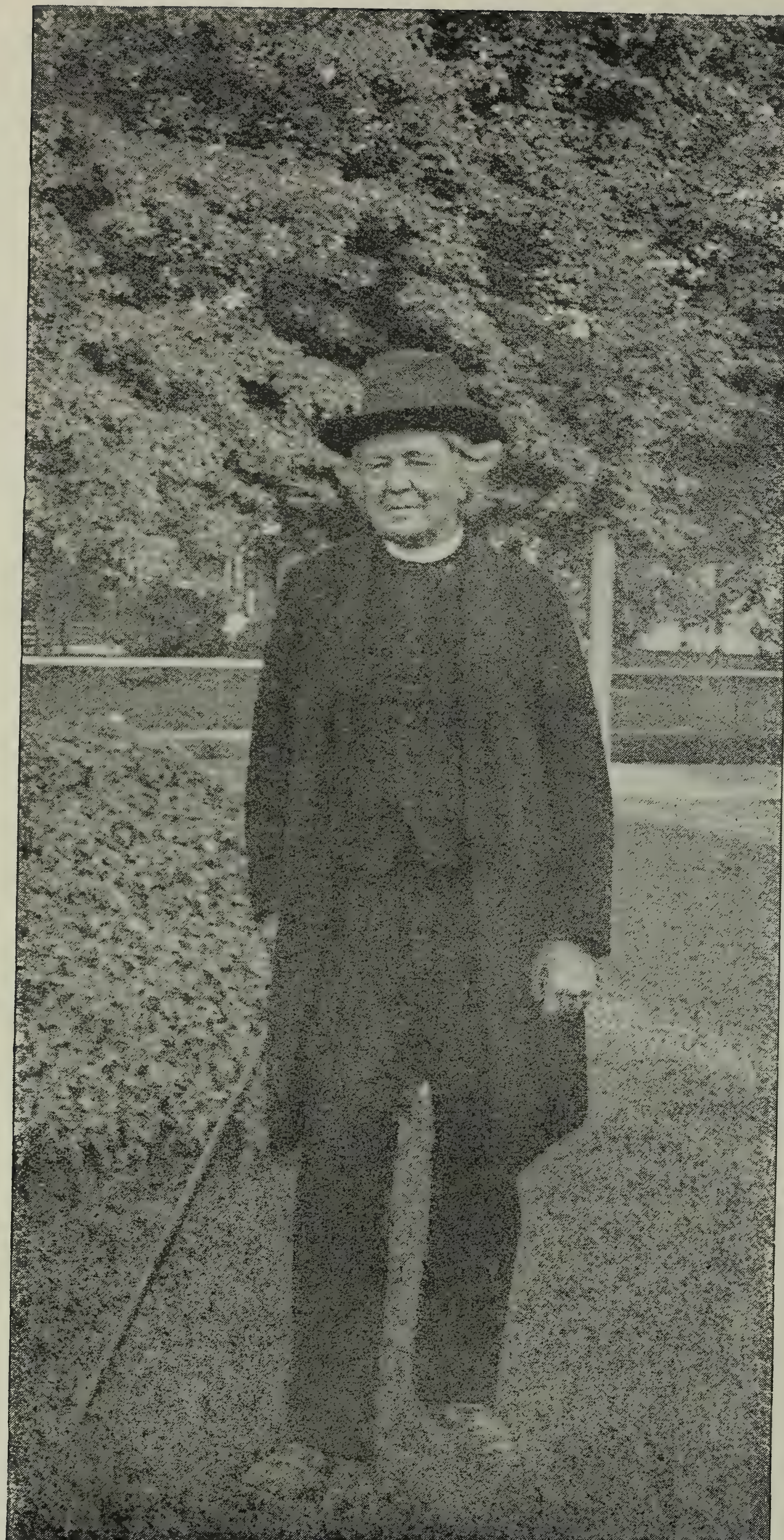
Worker Comb.—Comb having cells which measure five to the inch, in which workers may be reared, and honey or pollen stored.

Worker Egg.—A fertilized egg laid by a queen-bee, which may produce either a worker or a queen.

Picture Gallery of

Apiaries and Bee-exhibits

During the years since our journal, *Gleanings in Bee Culture,* was started, a large number of fine and beautiful engravings of apiaries and of bee and honey exhibits have been presented to our subscribers. These engravings were executed at considerable cost; and as they are instructive, and suggestive of many ideas in regard to apiaries and exhibits, we have thought best to put the better part of them in permanent form right after the body of this work. Instead of going to a large expense in visiting different apiaries, one can see how different beekeepers arrange their hives, and how their apiaries look. Each engraving in order will be found to contain some hint or distinctive feature which it is hoped will be found valuable. As our space is limited, we give a brief description of each engraving by number. The last of the series show photographic views of The A. I. Root Company's manufacturing and publishing plant. PUBLISHERS.



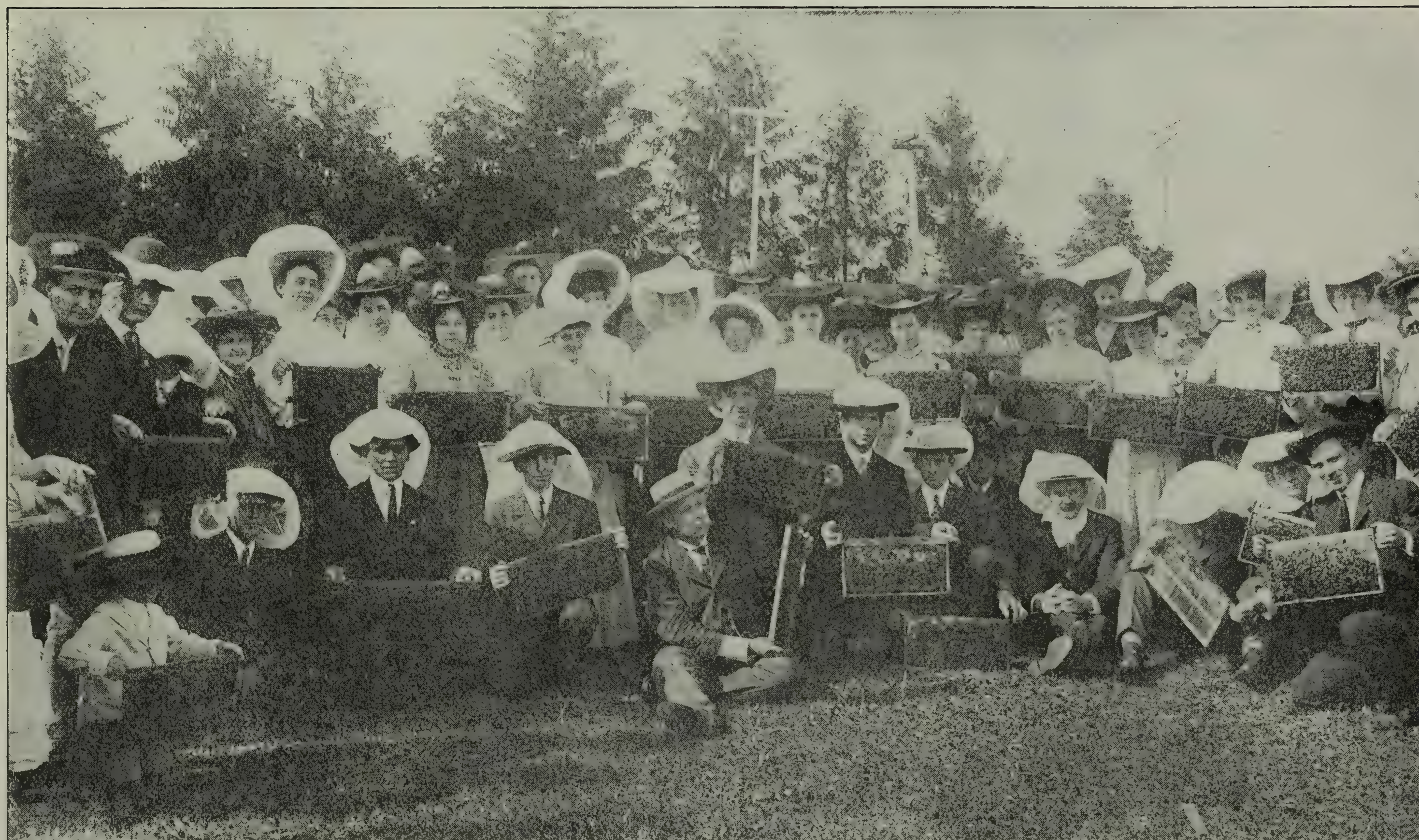
No. 1.—L. L. Langstroth in his Eighty-second Year.

No. 2.—Dr. C. C. Miller.

No. 3.—Apiary of The American Bee Products Co., Four Paths, Jamaica.

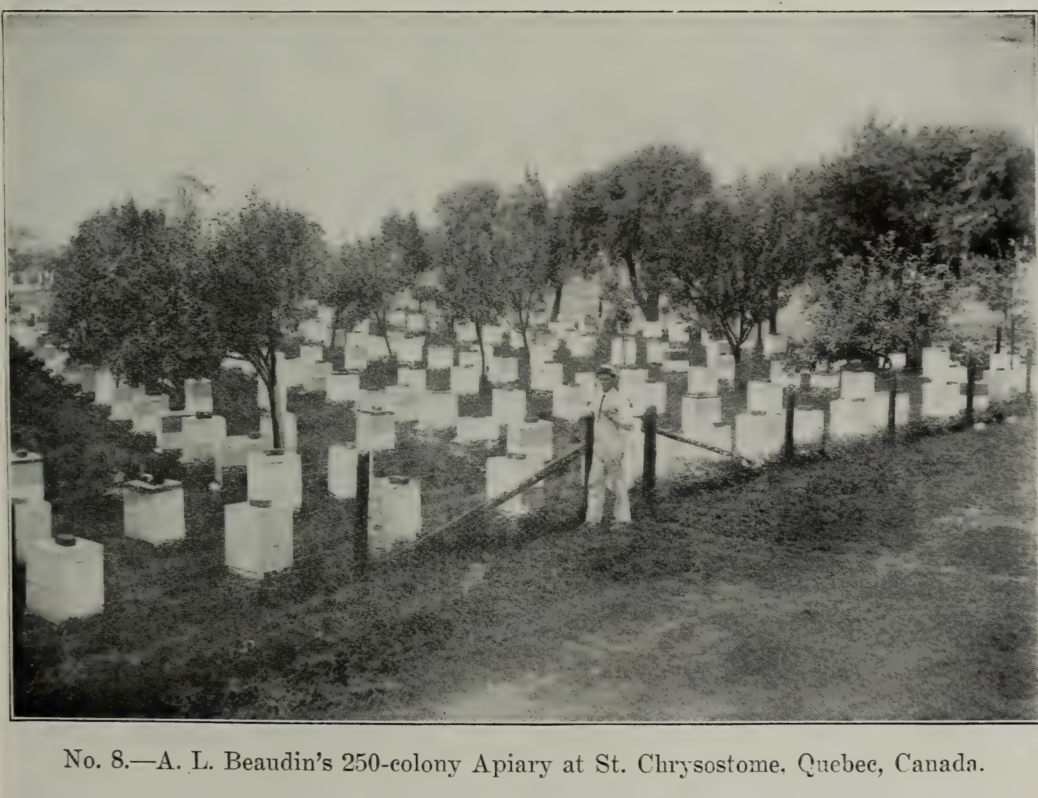
No. 4.—Grandpa Hutchinson Telling Stories to his Grandchildren.

No. 5.—L. C. Root, Veteran Beekeeper.



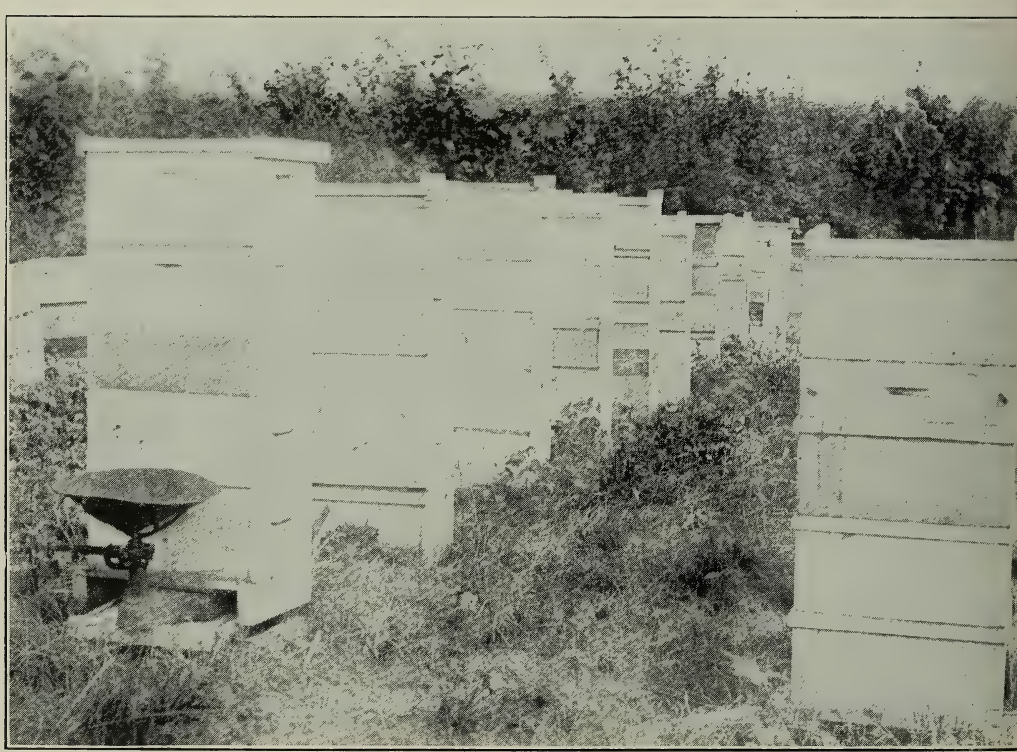
No. 6.—Swarm of Schoolma'ms and Schoolmasters after Taking Their First Lesson in Beekeeping at The A. I. Root Company's Home Apiary, Medina, Ohio.

No. 7.—A group of Boys who have Found out that Bees can be "Tamed."



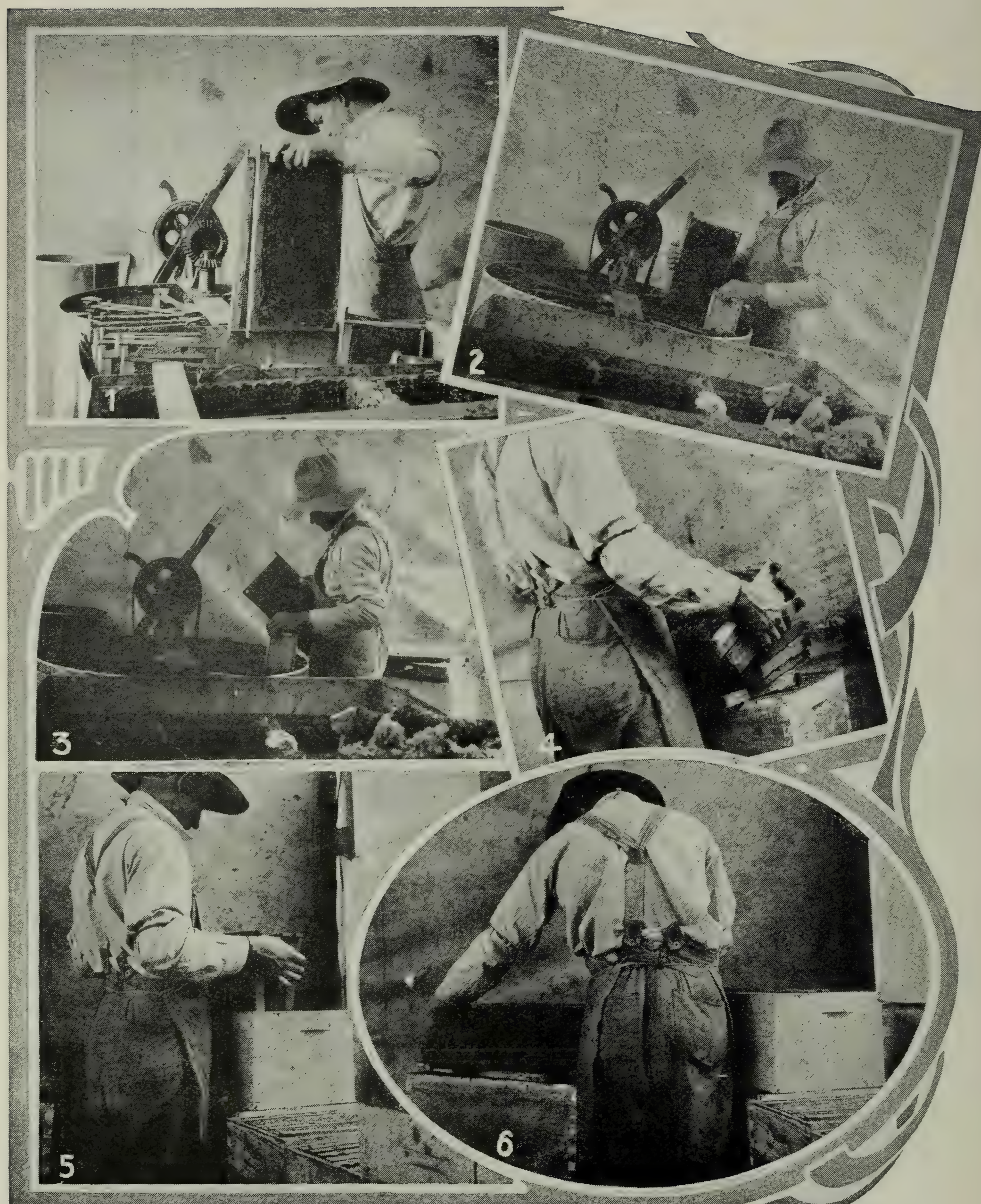
No. 8.—A. L. Beaudin's 250-colony Apiary at St. Chrysostome, Quebec, Canada.

No. 9.—Field meet of the Canterbury Beekeepers' Association, at Brookside, New Zealand.

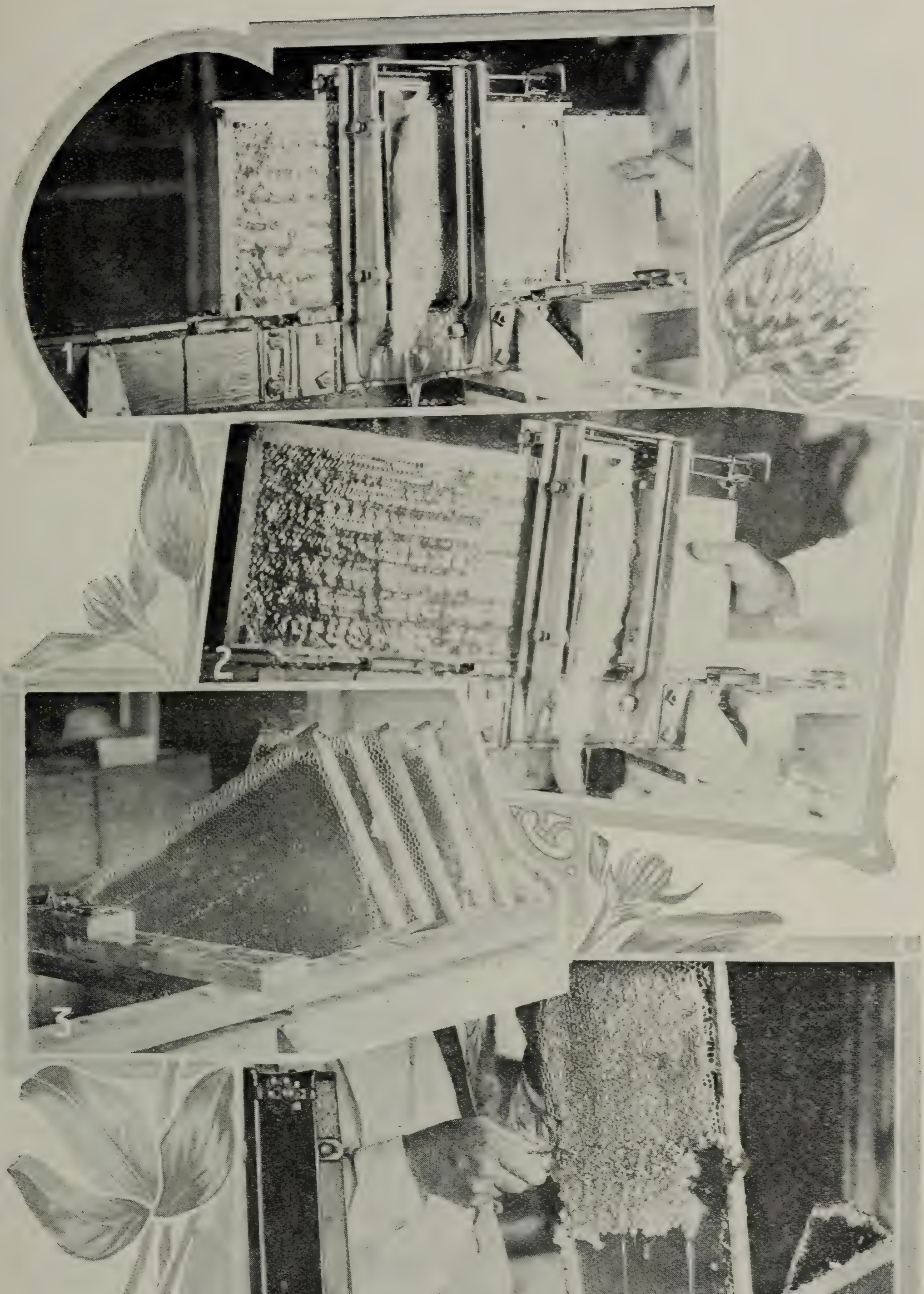


No. 10.—Eleven Colonies that Produced 1320 Pounds of Milkweed Honey in Eleven Days.

No. 11.—Beekeeping for Beginners, Illustrated.

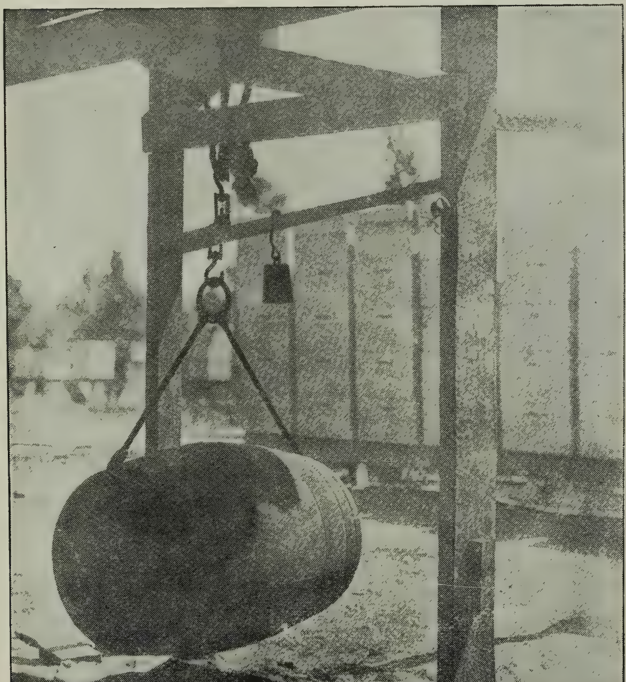


No. 12.—How Combs should be Handled when Extracting.



No. 13.—Uncapping Combs in a Ferguson Uncapping-machine and by Hand.

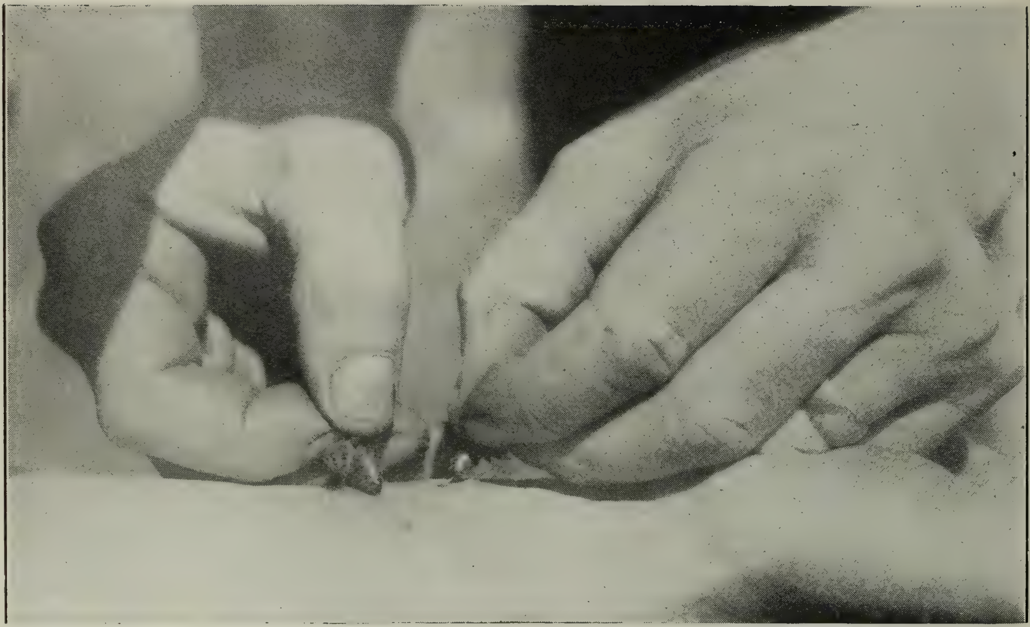
No. 14.—Marchant's Scheme for Weighing Honey in Barrels.



No. 15.—A closer View of the Scheme Above.

No. 16.—O. B. Metcalfe Carrying Supers of Combs to the Hives after Extracting.

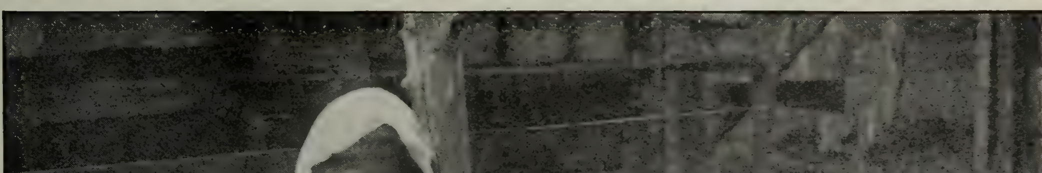
No. 17.—Owl Creek Apiary, Sumatra, Florida, during a Flood.



No. 18.—Bee-sting Applied to the Arm for Curing Rheumatism.

No. 19.—Fred W. Muth, of Cincinnati, Demonstrating the Bee-sting Cure.

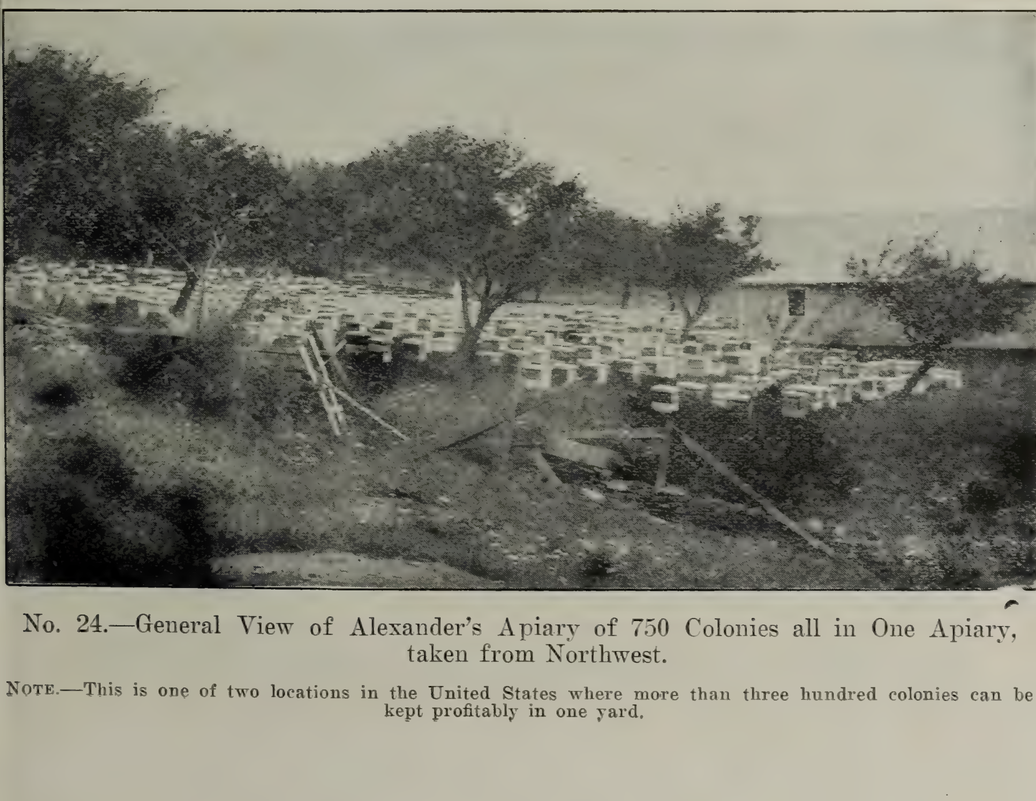
No. 20.—Making Straw Skeps in England.—*British Bee Journal.*



No. 21.—Method in Use in Holland of Finding a Queen in a New Swarm.

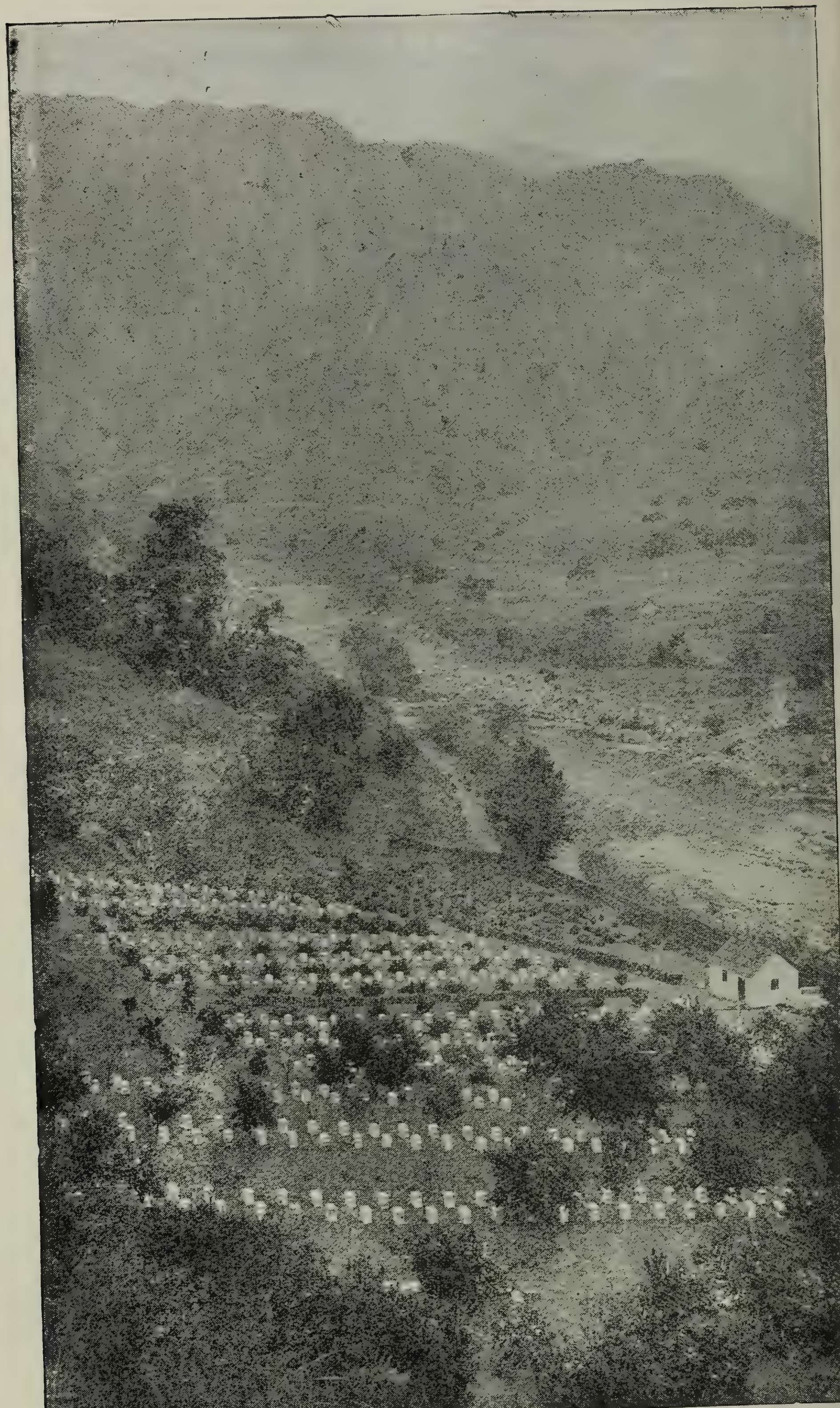
No. 22.—Apiary of John Bodenschatz, Lemont, Ill., Supported by Sweet Clover Sown in Waste Places by the Owner.

No. 23.—Hauling Honey to the Barn from the Apiary of Thorne & Ercanbach, Lovelocks, Nevada.



No. 24.—General View of Alexander's Apiary of 750 Colonies all in One Apiary, taken from Northwest.

NOTE.—This is one of two locations in the United States where more than three hundred colonies can be kept profitably in one yard.



No. 25.—The 500-colony Apiary of J. F. McIntyre, near Ventura, Cal., looking East.

No. 26.—Northern Michigan Apiary at the Close of the Honey-flow.

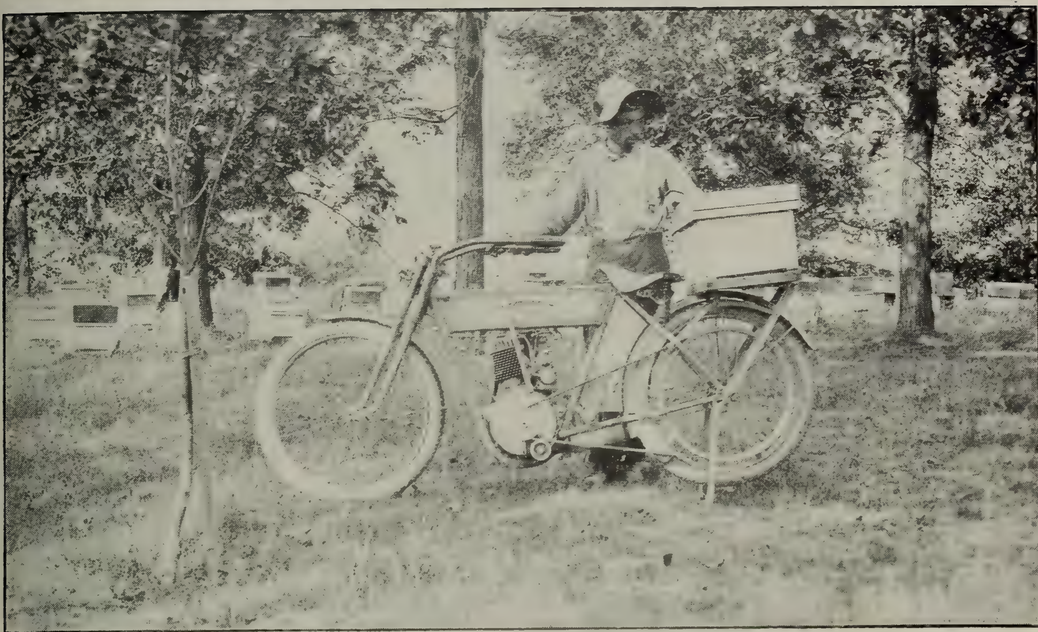
No. 27.—Geo. J. Van de Vord, of Daytona, Florida, Moving 41 Colonies of Bees on a Motor Truck that is Not Afraid of Stings.

No. 28.—One of E. L. Sechrist's Apiaries, Clarksburg, California.

No. 29.—One of the late W. Z. Hutchinson's Apiaries in Northern Michigan.

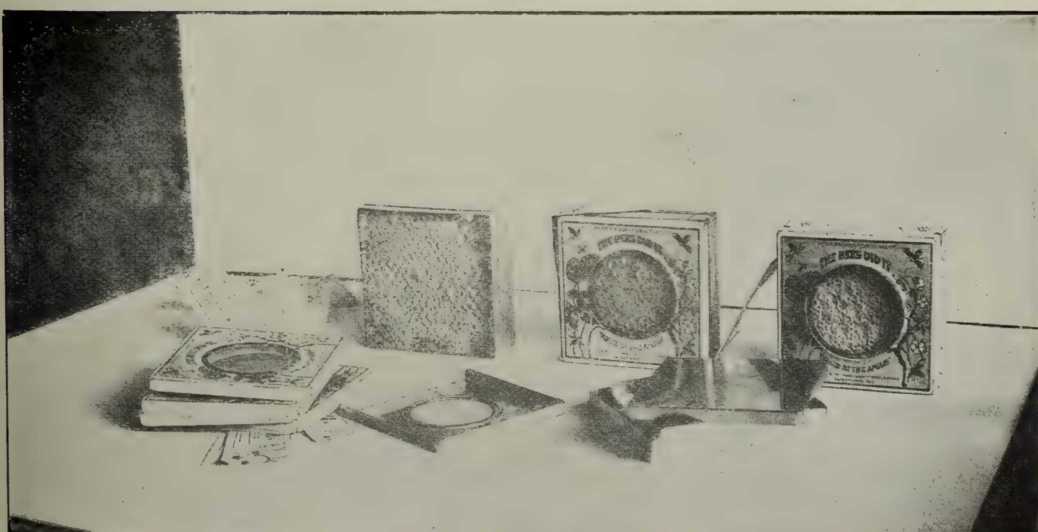
No. 30.—Mud Beehives in Jezreel, Palestine.

No. 31.—Apiary of W. J. McCarroll, Tropico, California.



No. 32.—Harley-Davidson Motor Cycle Used for Carrying a Load.

NOTE.—A machine of this sort is very useful for making quick trips where a series of outyards are used.



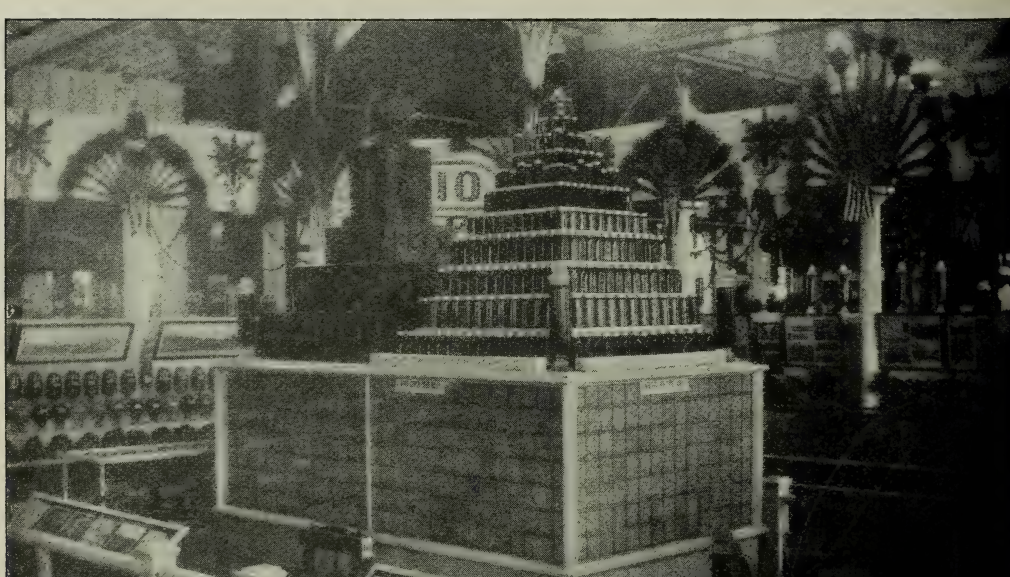
No. 33.—Comb Honey in Tin Sections.

Now as stern Winter throws his cutting blasts
Across each crag and fen and moor,
Securely housed in homes complete in every part
The bees now while away their time,
Discussing, as they may, with drowsy roar,
The prospects of another year to come.
Their garnered sweets, the fruit of honest toil,
Are spread around where all may eat,
And comfort reigns within.
So at the winter time of life
Let each find stored away for him
The fruits of life well spent
In search of virtue and her great reward.

No. 34.—An Ideal Windbreak.

No. 35.—Chicks in Summer, Bees in Winter.

No. 36.—F. W. Redfield's House Made of Honey for Exhibition Purposes.



No. 37.—The A. I. Root Company's Exhibit at the Jamestown Exposition.

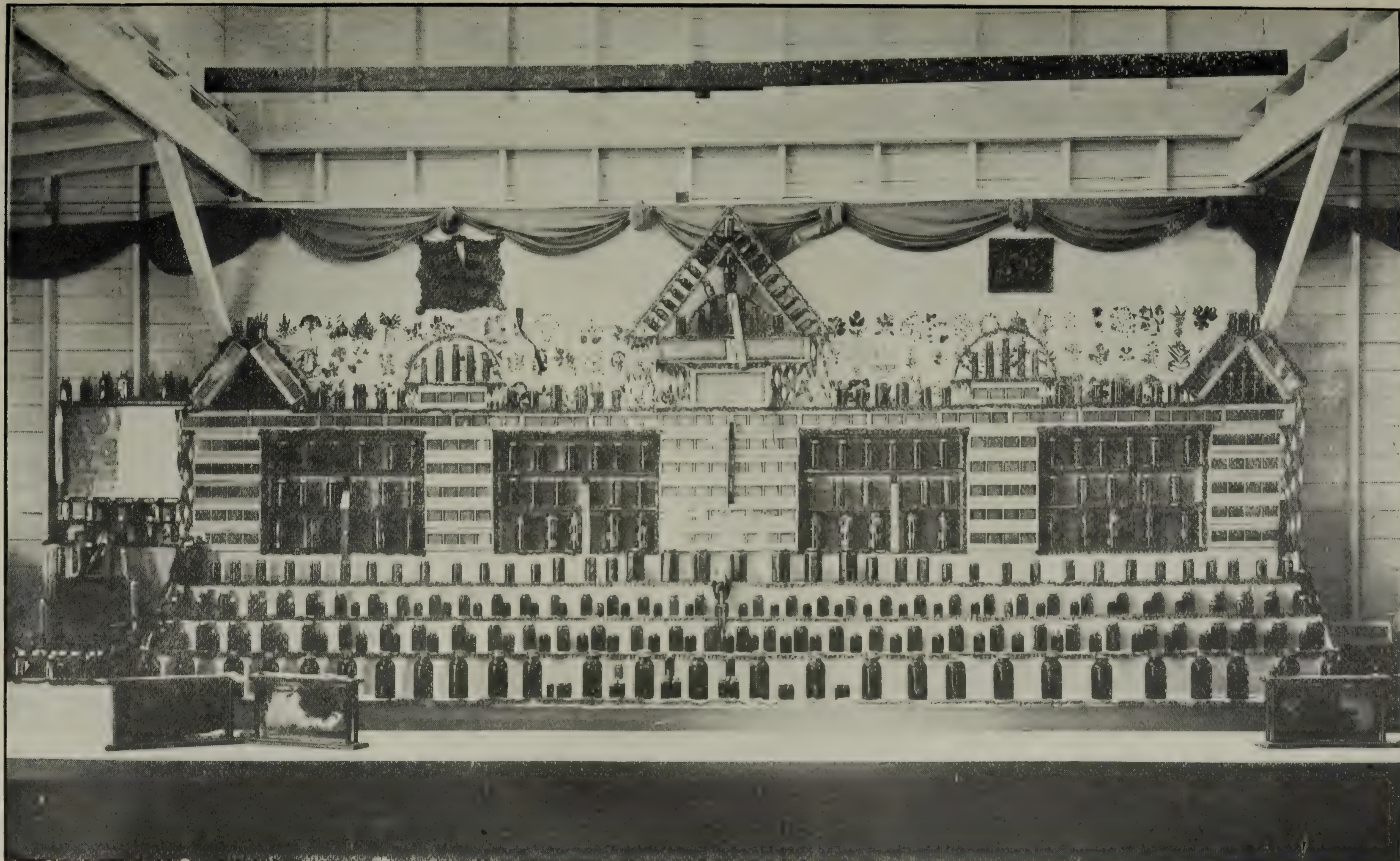
No. 38.—The Capitol Hive Containing Three Colonies and a Nucleus.

No. 39.—A Fine Exhibit at the Wisconsin State Fair, by William E. Prisk.

No. 40.—Apiary of W. T. Richardson, Simi, California.

No. 41.—Disinfection of Hives and Supers by Fire.

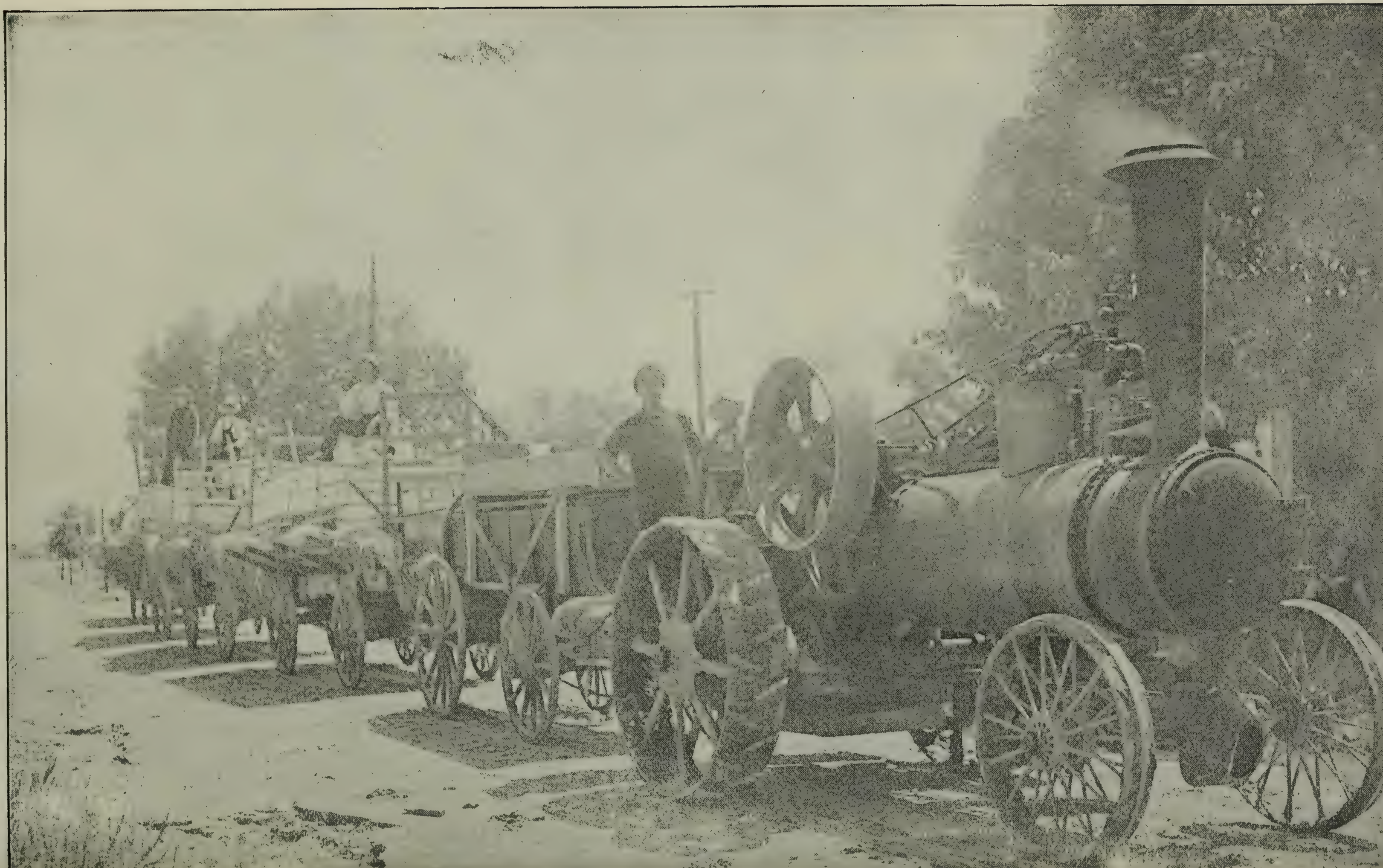
No. 42.—Mr. Carl Ludloff, of Mexico, and his Simplex Hives.



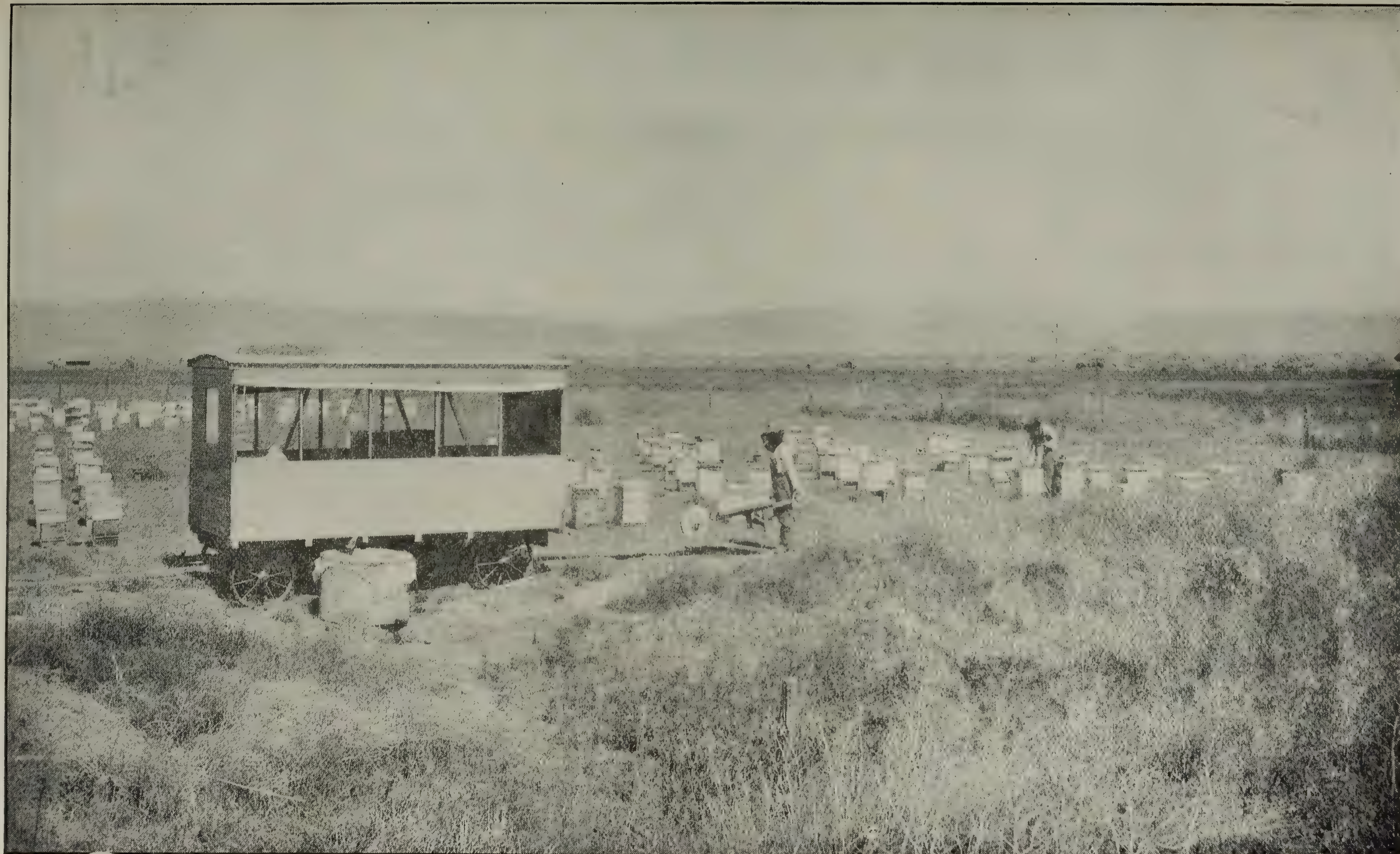
No. 43.—One of the Honey Exhibits in the Apiarian Section of the Spokane Interstate Fair.

No. 44.—Honey-house and part of Apiary owned by W. S. Hart, East Coast, Florida.

No. 45.—G. C. Greiner, La Salle, N. Y., under his portable Tent.

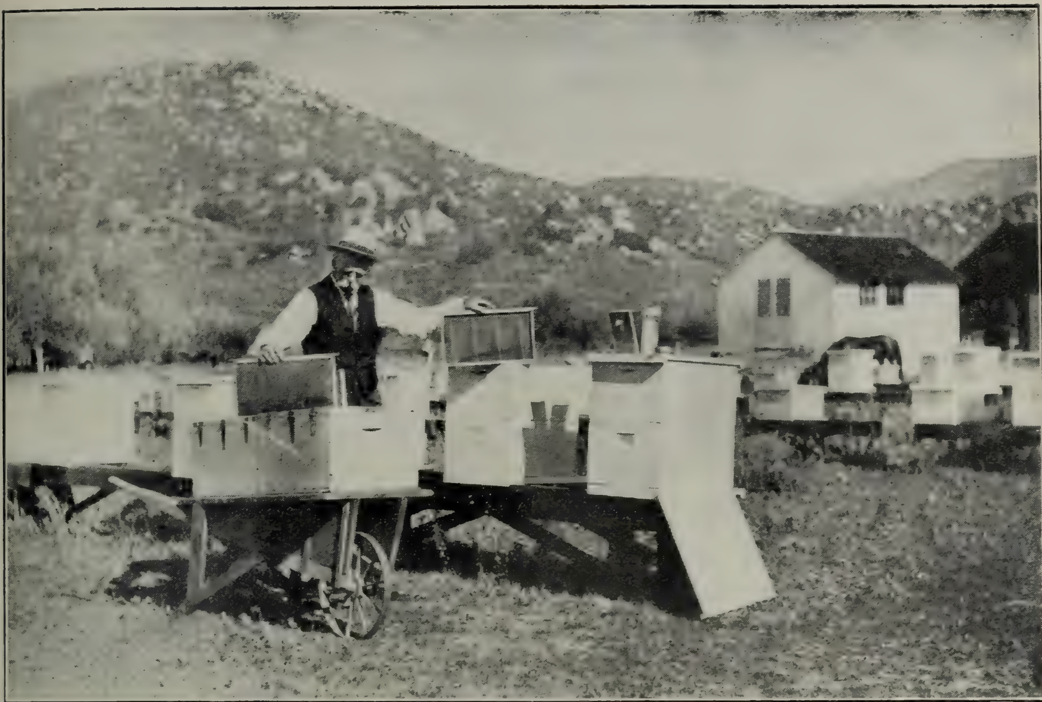


No. 46.—Moving Four Wagon-loads of Bees by Traction-engine in Canada.



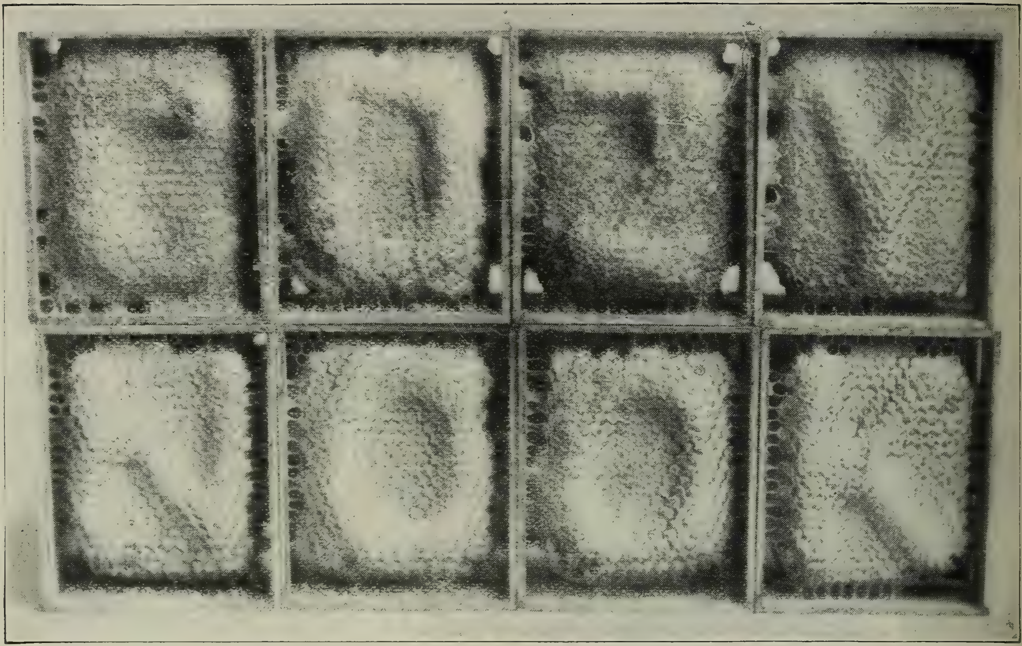
No. 47.—Virgil Sires' portable Gasoline-engine Extracting-outfit.

No. 48.—Crowder's Extracting-house on Wheels, Selma, California.

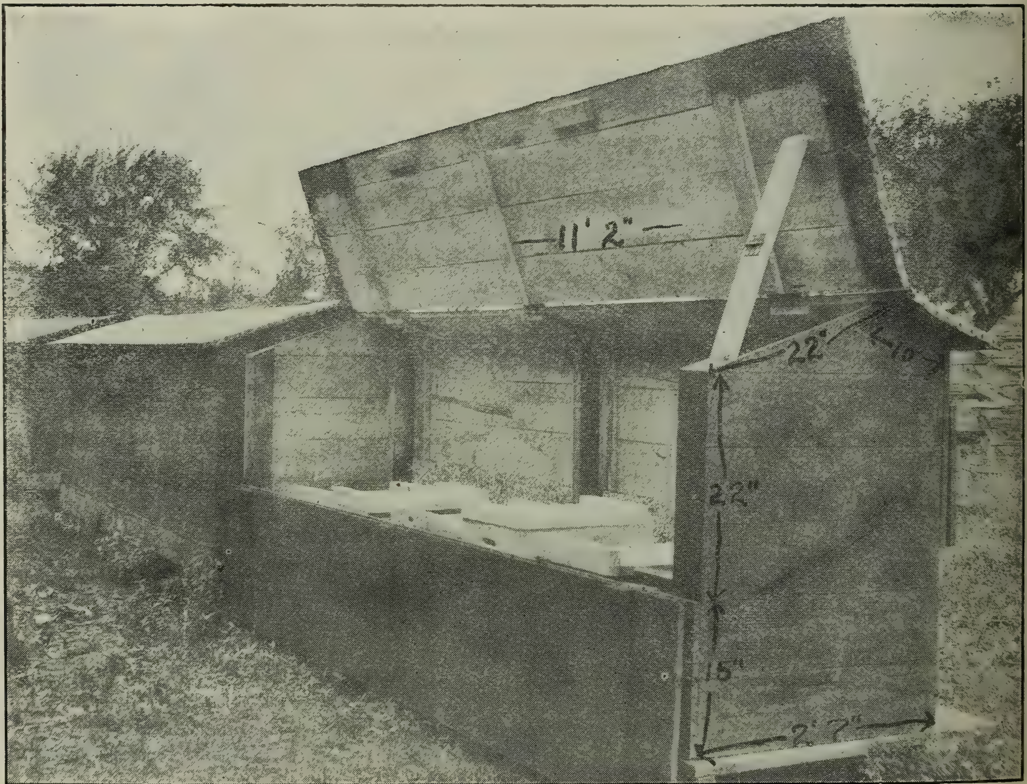


No. 49.—Gibson's 75-cent Wheelbarrow, Good as New, after Fifteen Years of Hard Service.

No. 50.—J. S. Cottrell's Apiary and Side-hill Honey-house, Auckland, N. Z.



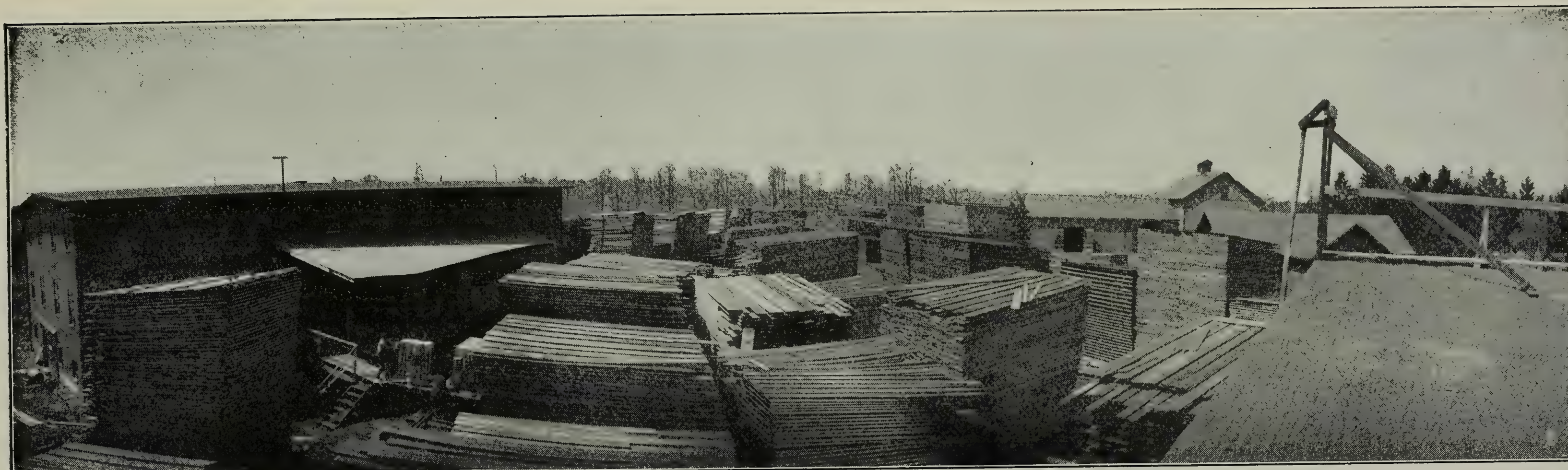
No. 51.—A Sample of how Bees can be made to Spell.



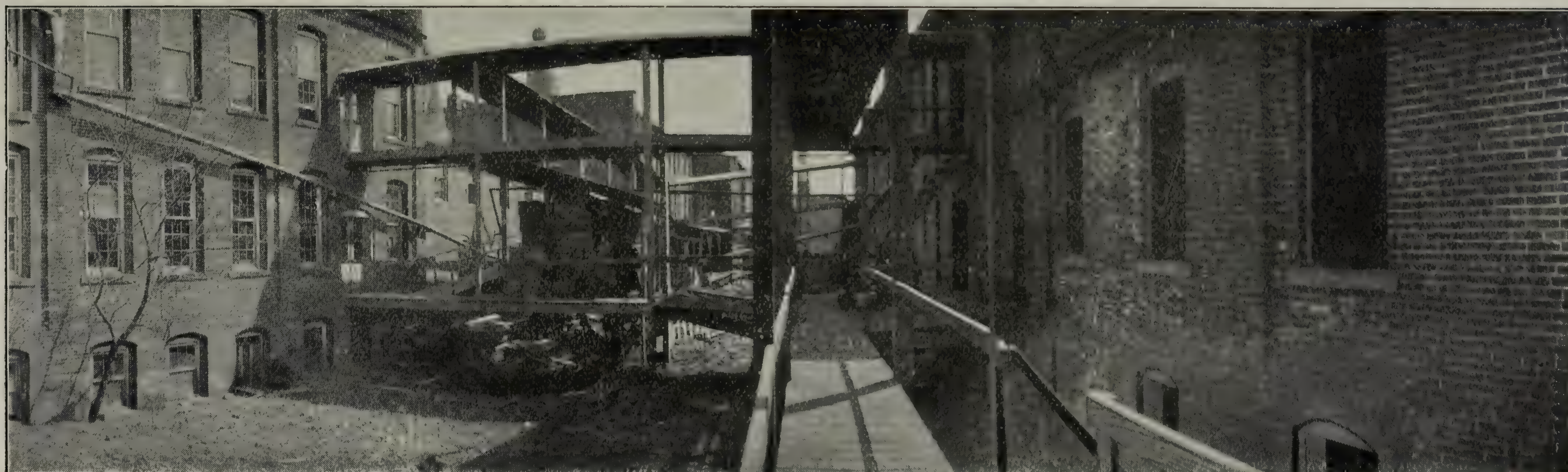
No. 52.—The back of a Winter Case opened for Inspection.

THE engravings that follow next in order show the hive-manufacturing and publishing plant of The A. I. Root Company, located at Medina, Ohio. As we have hundreds of visitors who come every year to look over this peculiar establishment, the output from which is devoted almost exclusively to the interests of the bee, we thought that many of the readers of this work, living a thousand miles or more away, might like to pay us a visit. We are glad to give them this opportunity so far as it is possible by the aid of the camera.

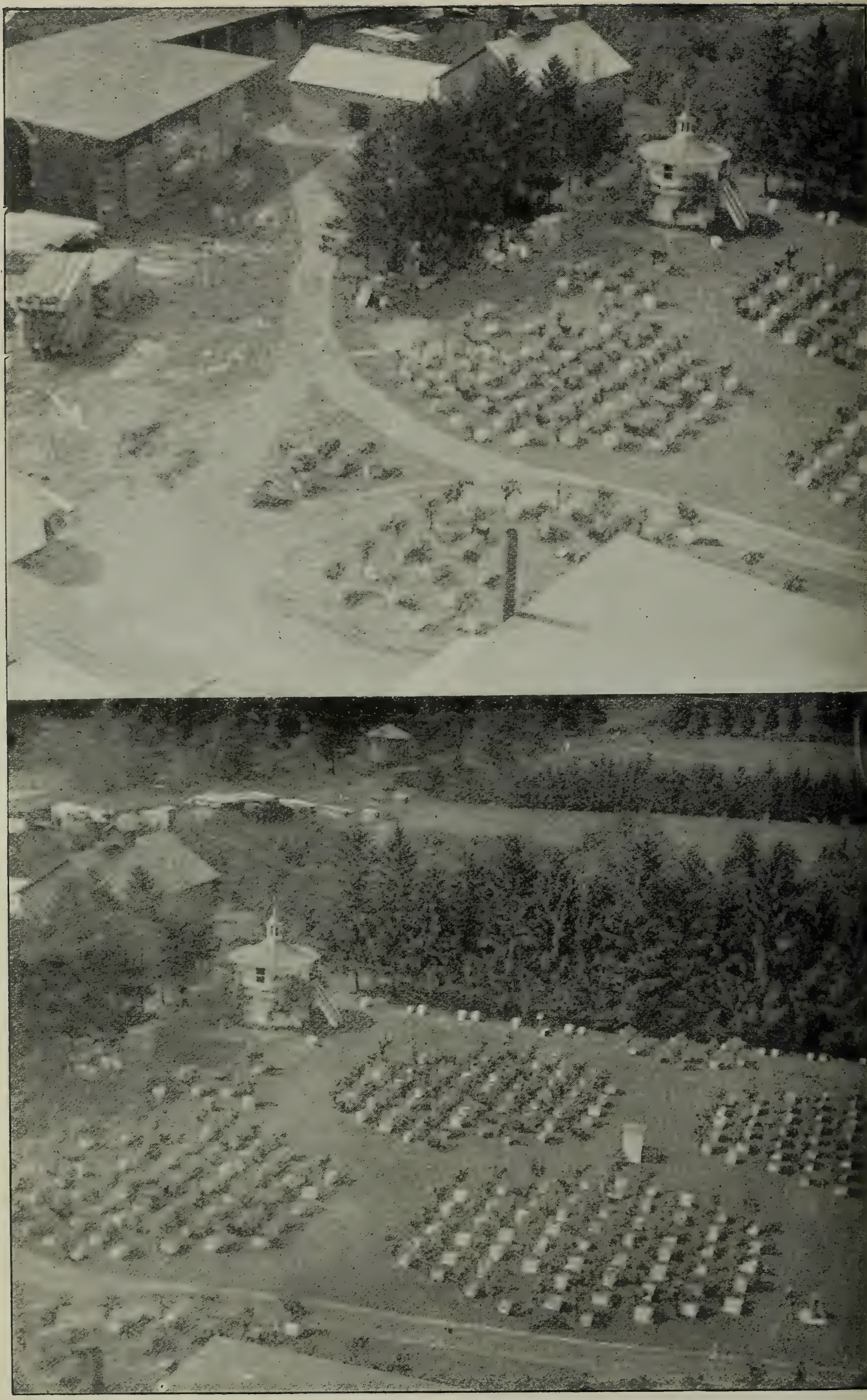
THE A. I. ROOT COMPANY. By E. R. Root.



Views of a Part of The A. I. Root Company's Lumber-yards.

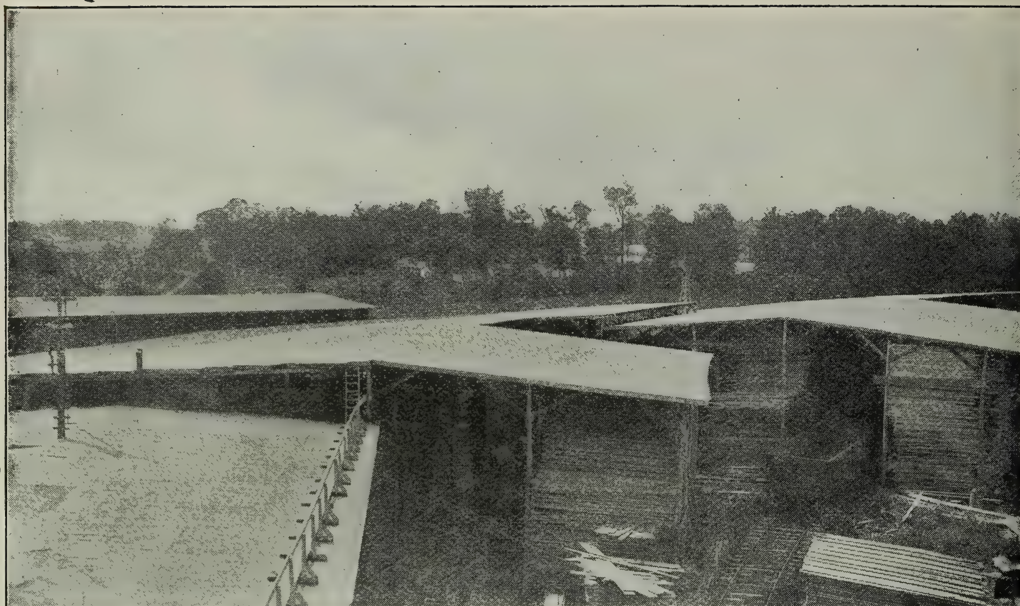


The A. I. Root Company's Manufacturing Plant. Upper View from the Southeast. Lower Cut Shows Court between some of the Buildings.



View from top of our Smoke-stack of a Part of Our Home Apiary in 1906, Showing the Hexagonal Design and the Wall of Evergreens, as Planned by A. I. Root in 1877.

View of Covered Lumber-yard Containing the Material for Beekeepers' Supplies, as seen from the Top of the Smoke-stack.

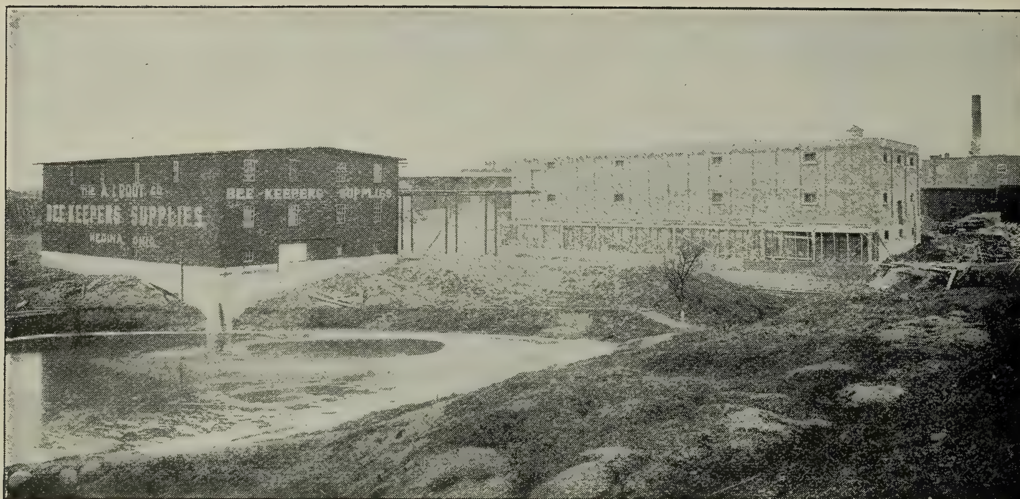


The A. I. Root Company's Lumber-sheds where an Aggregate of $75,000 Worth of Lumber is Stored at One Time.

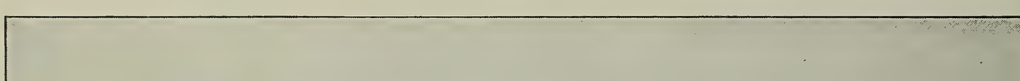
Part of The A. I. Root Company's Lumber-yards.

Partial View of the A. I. Root Company's Manufacturing Plant, looking from the south.

The A. I. Root Company's Fireproof Warehouse, 148 x 48, three stories, with loading-platform and steel bridge connecting old Warehouse on the south.



Two of the A. I. Root Company's Warehouses, with a floor-space of 37,000 square feet.



The East and West Railroad Connections and the Warehouse Facilities of The A. I. Root Company.

Upper View Shows The A. I. Root Company's Office and Publishing House. Lower View Shows the Interior of the Printing Department.

Interior View of The A. I. Root Company's Office.

" Gleanings in Bee Culture " Ready for the Postoffice.

NOTE.—The view shows only about one-third of the list ready to mail.

Description of Foregoing Illustrations

No. 1. — A full-size view of father Langstroth while taking a walk in one of the parks of Dayton, Ohio. Mr. L. was 82 years of age when this picture was taken.

No. 2.—Some years ago—yes, nearly twenty—I said to Dr. Miller, "You have a peculiar talent for making bright comments in convention, throwing in a few sentences and then sitting down. The comments always enlighten the proceedings. Now, can you not edit a department in *Gleanings* made up of short items of running comment, something after the style of your convention work?"

Turning to me he said, his wonted smile vanishing for the moment into a serious expression, "Ernest, I doubt my ability to carry out your ideas, but I have confidence in your opinion. I will try it. If you do not like the stuff, throw it into the waste-basket."

There, now you have the origin of Stray Straws. We had a department running, as we do now, called "Heads of Grain," and I suggested "Kernels of Wheat" as an appropriate heading; but Dr. Miller very modestly preferred Stray Straws, as he was not sure that he would be able to glean very much *wheat*. As to the general character of the Straws, and whether they are worth binding along with the other gleanings from many fields, I don't need to say. Our readers have long since settled that by the eager way they grab at the Straw-stack in Marengo.

Dr. C. C. Miller is probably one of the best-known apicultural writers in the world. He reads both the American and European exchanges, and his articles and comments on both sides of the Atlantic have brought him into prominence throughout all beedom.

His writings are further enhanced by a ripe experience of many years, for he is now in his seventy-eighth year, having been for forty years a beekeeper, and a good one, especially in the production of comb honey; and, if I mistake not, his crops are sold before they are off the hive. This speaks volumes, not only for his methods of management but for his careful honest grading, which is all done by the members of his family. The buyers know in advance just exactly what Dr. Miller's honey is going to be, and they are usually willing to pay above the market because they know beyond any question that there will be no after-quibble over the grading, quantity, or quality. There is no reason why many others can not sell their crop in the same way.—*E. R. Root, in Gleanings in Bee Culture for Aug. 1, 1908.*

No. 3.—This represents the apiary of the American Bee Products Co., Four Paths, Jamaica. Although in a perpetual summer, toads and ants are the scourge of bees there, and will clean out a hive in one night—honey, bees, and all. Jamaica, fortunately, is free of foul brood.

No. 4.—Here is a beautiful glimpse into the home life of the late W. Z. Hutchinson, Flint, Mich., the founder of the *Beekeepers' Review*. Better than words, it shows the true spirit that ever actuated this prince among beekeepers and men of all ranks. The children are his grandchildren, their mothers being twin daughters of Mr. H. On the 30th day of May, 1911, he was called from the scene of his earthly labors.

No. 5.—L. C. Root, of Stamford, Ct., son-in-law of that pioneer in modern beekeeping, Moses Quinby, of whom he may be called a living continuation, and author of Quinby's New Beekeeping, a work that has had a large sale. Mr. Root is still interested in bees, and talks at various bee gatherings. Dr. E. F. Bigelow, of Sound Beach, Ct., calls himself a pupil of Mr. Root. Few beekeepers in America are more widely and favorably known than Mr. R. He is in the front rank of all moral reforms.

No. 6.—Represented in this picture are school-teachers from all parts of the United States in the act of holding brood-frames covered with adhering bees. These teachers were part of the summer school (1905) of Wooster University, Wooster, Ohio, where they had been taking instruction in "Nature Study," under the instruction of Dr. E. F. Bigelow, Stamford, Ct., editor of the Nature department of *St. Nicholas Magazine*. Dr. Bigelow occupies a sitting posture in the middle foreground with his left foot resting under his right knee. The illustration affords a very striking proof of the gentle nature of the red-clover strain of Italian bees. The picture was taken after their first lesson in beekeeping.

No. 7.—In sending us this photograph, Dr. E. F. Bigelow, of Sound Beach, Ct., says, "These are the sons of wealthy parents, of Greenwich, Ct., who have a special tutor to care for them and take them around. They requested that I give them a lesson on bees, and this is their first experience. They received only two stings during the hour."

No. 8.—This view represents the apiary of A. L. Beaudin, St. Chrysotome, Quebec, containing 250 colonies. Mr. B. is a progressive beeman, and in 1910 took 26,000 lbs. of extracted honey and 256 lbs. of wax. The bees were in one yard, which is a model of neatness and efficiency. The shade is ample in summer, and yet the trees do not prevent a free circulation of air.

No. 9.—A field meet of the Canterbury Beekeepers' Association, held March 17, 1912, at Brookside, N. Z. The weather, of course, is the reverse of that in the Northern States in this country. The situation is an ideal one, having a large belt of trees on the south. There are acres of white clover within a quarter of a mile. The whole scene is in keeping with other things in this happy and prosperous province.

No. 10.—This represents what we may call a big business on a small scale, showing eleven colonies at the close of an eleven-day flow from milkweed in July, 1911, in the apiary of Geo. H. Kirkpatrick, Rapid City, Mich. The amount of honey from that rather unusual source was 1320 lbs. in the time stated. Note the hives stacked up for weighing. Mr. K. is one of Michigan's most prominent beemen.

No. 11.—Fig. 1 of this view represents the act of smoking the bees down from the upper super. Fig. 2 shows how to loosen the lowest super and to smoke the bees down from the top of the brood-chamber. Fig. 3 represents the sliding of one comb after another to the side of the hive to brush off the bees. These views show the operation as practiced by E. D. Townsend, of Michigan, the photos being taken at his yard.

No. 12.—These views represent the practice of O. B. Metcalfe, of Mesilla Park, N. M., in handling frames rapidly while extracting. Fig. 1 shows the act of lifting two frames from the frame-box with the left hand prior to putting them into the baskets at once, as shown in Fig. 2. Fig. 3 shows the manner of unloading the extractor. In Fig. 4 the operator is seen in the act of picking up four frames at once to place them in the super as in Fig. 5. In Fig. 6 the operator is seen reaching back for three more frames to make out a super of seven frames.

No. 13.—This picture represents a Ferguson uncapping-machine and the work of uncapping by hand. Figs. 1, 2, 3, show that the work is well done when conditions are favorable. When the honey is just warm enough the combs run through as if greased, both sides being uncapped at once, and more evenly than by hand, as seen in Fig. 4. A new hand with the machine can do more and better work than a skilled operator can with a knife. The inventor is Mr. L. R. Ferguson, of Harvey, Ill.

Nos. 14 and 15.—This picture illustrates the method used by Mr. A. B. Marchant, of Sumatra, Fla., for weighing his 50-gallon barrels filled with honey. One man seizes the end of the pole (next view); the steelyards are attached while a second man rolls the barrel under the hooks. The steelyards are dropped till the hooks catch over the ends of the barrel, which is then raised enough to clear the ground, when the weight is taken. The lower cut shows the same operation from an opposite direction. The whole operation is almost instantaneous.

No. 16.—This picture shows how Mr. O. B. Metcalfe, of Mesilla Park, N. M., carries supers of empty combs to the hives after extracting. No. 1 shows the operator picking up a load of hive-bodies. In No. 2 he is seen setting the pile on the first of the uncovered hives. In No. 3 we see the beeman spacing combs, and in No. 4 he is using a canvas inner cover to make some combs stand up straight and stay spaced when they do not want to.

No. 17.—This picture shows the Owl Creek apiary of Mr. A. B. Marchant, of Florida, during a flood. But for some hard work in raising the hives up on empty supers this yard would have been lost. It was intended to fill a carload order for bees from this yard, but the "watered stock" made it impossible.

No. 18.—Stings as a cure for rheumatism have been recommended for many years, some reporting happy results while others received no benefit. The picture illustrates the application of a sting to the arm of Mr. John Renner, of Cincinnati. He had been afflicted with rheumatism for years; but soon after the stings were applied he was able to walk sprightly without the aid of a cane. He received from three to five stings twice a week till seventeen had been applied. His case is remarkable, although by no means exceptional.

No. 19.—This half-tone represents Mr. F. W. Muth, of Cincinnati, demonstrating that stings cure rheumatism by making a practical application of one to the arm of a man, referred to above. Physicians attribute the beneficial effect of stings to the action of formic acid in the blood.

No. 20.—This shows how straw skeps are made in England. These are still made in England to a limited extent, and some of the advanced beekeepers use them for taking down swarms, in temporarily housing swarms, and for various other uses in the apiary. Being light and cool these skeps are handier than a box.

No. 21.—This view was taken in Holland, and represents a beekeeper hunting for the queen. The photograph was furnished us by Mr. Henri Meyer, of Arnhem, Holland. He regrets the backward condition of the people there in regard to bees while science in general is so thoroughly understood there. He says the beemen kill their bees in the fall, and thus secure a small quantity of inferior honey.

No. 22.—The peculiar feature of this apiary is that the honey is almost wholly obtained from sweet clover which was sown in waste places by the owner several years previous to the taking of this view. It will be noted the supers are in place and the crop here represented when gathered weighed 12,000 lbs., nearly all of it from sweet clover. The apiary is situated in the heart of the town of 3500 inhabitants. The building in the background is the honey-house. It is evident the owner of this apiary is a keen and successful beekeeper, and as a matter of fact the honey sold from it enabled its owner to start a drugstore. He admits not being able to keep away from the bees, and the shipshape appearance of every thing would indicate that to be the case.

No. 23.—This view is thoroughly characteristic of Nevada, showing the bonanza system on which bees are kept in the sage-brush State. The honey usually obtained is not only conspicuous by its quantity, but its quality as well. Owing to the fact that the honey is mostly collected from alfalfa clover, and the extreme dryness of the climate, the honey of Nevada is never surpassed in color, flavor, or density combined. It is not unusual to see piled up underneath the cottonwood-trees ten or twenty tons of honey awaiting an opportunity to ship it to the eastern markets, where it is highly appreciated. Owing to the extreme dryness of the climate it is wholly impracticable to use wooden packages, and tin takes its place altogether, as is shown by the illustration. Those who look on Nevada as a desert will probably be astonished to know it is an excellent honey-producing State.

No. 24.—View in the famous apiary of 750 colonies, all in one apiary, owned and managed by the late E. W. Alexander, of New York, and now by his son. It is hardly possible to show in one picture 750 hives, but the view marked 10 gives us an idea of the extent of the apiary.

No. 25.—This shows a general view of J. F. McIntyre's apiary, located about three miles from Ventura, Cal., on the Big Sespe River. Those who have the older editions of this work will remember a wood engraving of this apiary, then owned by the father-in-law of Mr. McIntyre, R. Wilkin, a name known the world over among beekeepers. Mr. McIntyre keeps track of his colonies entirely by the use of a record-book. The hives are all painted white, and look like a miniature city. The surrounding mountains form a very picturesque feature in the scene. At the right in No. 10 is the honey-house. At the left of the honey-house are three large tanks, not shown, holding four tons each. A full description of this, one of the most important apiaries in California, will be found in *Gleanings in Bee Culture*, Oct. 1, 1891.

No. 26.—This picture, taken by the late W. Z. Hutchinson, represents an extracting apiary toward the close of the honey-flow in northern Michigan. The supers are stacked up four and five high. No sight can be more agreeable to a beekeeper than a nicely kept apiary of skyscraper hives.

No. 27.—This peculiar picture represents Mr. Geo. J. Van de Vord, of Daytona, Fla., moving 41 colonies of bees, using only tobacco smoke to keep them in the hives. Mr. V. has moved bees over four years without screens over the entrances. The read-

er will note how the automobile is coming into use for such work, where the use of horses would be dangerous.

No. 28.—This is a view of one of the apiaries of E. L. Sechrist, Clarksburg, Cal. Mr. S. is one of the leading and progressive beekeepers in that State of big things; and the orderly arrangement of this apiary, its freedom from weeds, etc., show the secret of its owner's success.

No. 29.—This is a view of an apiary belonging to the late W. Z. Hutchinson, and the photograph was taken by him. Mr. H. had probably done more to illustrate the bee world with his own camera than any other man—a work in which he delighted and excelled. The apiary itself is located in the wilds of Northern Michigan, where wild red raspberries cover the ground for miles, yielding generously one of the finest honeys known.

No. 30.—This represents one class of hives peculiar to the Holy Land, this one having been photographed at Jezreel, Palestine. While primitive, there is something about the ingenuity displayed in the construction of such hives that commands our admiration, and they still remind us that "the land which the Lord giveth thee" still flows with honey if not milk.

No. 31.—This beautiful picture was shown the author of this book (E. R. Root) while he was in Los Angeles. The location is six miles north of Los Angeles, and is an ideal place for wintering. The foot of the mountain, in the background, is such as may be seen there on all unreclaimed land. Between the mountain and hives may be seen a growing crop of alfalfa. The trees at the left are probably orange. Each hive is the center of six others standing around it, and they are far enough apart so one can walk around each hive. The extracting-room is a cloth tent. An iron pipe leads from the extracting-room to the storage-tank. The highest yield Mr. McCarroll has had per colony is 200 lbs. of extracted honey.

No. 32.—As a cheap and rapid method of carrying hives, etc., from one place to another, the motor cycle is fast supplanting the horse. This view shows a Harley-Davidson motor cycle as used for carrying a load.

No. 33.—This picture gives a view of some of the methods used for putting up comb honey. Here we have labels, tin boxes, and the finished package ready for market. The tin covers, one of them having a celluloid front, are slipped over the tin section, melted wax being used to make a tight package, and then the label is put on, extending completely around the box.

No. 34.—This view is given mainly to show an ideal location in regard to windbreaks, the best of which are the trees shown. In such a location the bees can be wintered successfully if anywhere.

No. 35.—R. O. Dickson's poultry-yard at La Harpe, Ill., showing brooder-coops used as winter cases, for 55 single-walled hives. Chicks occupy the coops in the summer in connection with Cypher hovers.

No. 36.—A view of Mr. F. W. Redfield's house made of honey for exhibition purposes. The walls are entirely of cans filled with honey; boards are used to support the cans on the roof. It was shown in Ogden, Utah, in 1909.

No. 37.—This illustrates the bee and honey exhibit of The A. I. Root Co. at the Jamestown Exposition, Jamestown, Va., in 1907.

No. 38.—This is a scene in the apiary of W. H. Horstmann, of Chicago, Illinois. The main part of the apiary is not shown, as he has quite a fair-sized apiary on a city lot. This view shows his Capitol hive made by him in his spare moments. It is quite useful since it contains three full colonies of bees and in addition a nucleus. Mr. Horstmann is a mail-carrier attached to the Chicago postoffice, but yet he finds time to attend to his bees. His example is worthy of emulation by many others who desire some avocation to occupy spare time.

No. 39.—The honey exhibit made by William E. Prisk, of Mineral Point, Wisconsin, at the State fair. It might be termed a model exhibit; and any person wishing to make an exhibit at some local fair can obtain ideas from it that will prove useful. Fairs are an excellent means of advertising honey in a very satisfactory manner, and the honey sold quite frequently pays all expenses. In addition, customers are gained who will be steady buyers for years after.

No. 40.—The leading honey-producer of Southern California is W. T. Richardson, of Simi. One of his apiaries is represented in the picture, a grotesque appearance being imparted to it by the stones on the hives, to keep the covers from blowing off. The view is one of many taken by Rambler while making the rounds of the bee-yards of California. Mr. Richardson runs about 1200 colonies, in four apiaries, all situated in the Simi Valley. A full account of his history is given in *Gleanings* for 1898, page 720, where a portrait is given of this famous bee-man.

No. 44.—These four views illustrate the wholesale disinfection of foul-broody hives at the apiary of Louis H. Scholl, New Braunfels, Texas. Fig. 2 shows the pile of hive bodies and supers. Kerosene is poured down the stack of empty bodies, Fig. 3. A lighted bunch of straw, Fig. 4, is thrown in, which sets the whole mass on fire. A spadeful of earth below, Fig. 5, at the draft, and a cover on top, finishes the job.

No. 42.—These views were taken in Mexico, and represent Mr. Carl Ludloff and his Simplex hives. No. 8 shows the orderly condition in which the hive is kept. No. 9 shows three of these Simplex hives. No. 10 shows a Simplex hive opened up, with a good covering of bees on the brood and honey. To prevent severe cases of robbing in time of a sudden cessation in the honey-flow, a bee-tent of canvas is clapped over a hive, as in No. 11. Two men can easily carry it about. No. 12 shows one of the queen cylindrical hives in use by the Mexican beekeepers around Irapuato. They are generally suspended under the eaves. These are one of the things that Mexico has preserved from the time of the Spanish Conquest, and show the tenacity with which the natives cling to all old customs while newer and better plans are crowding in upon them.

No. 43.—One of the best ways to popularize the use of honey is to let the people see it as a preliminary to tasting it. The view shown is well described by the title under it. While such exhibits must necessarily vary in appearance according to the goods displayed and the room occupied, this view may be taken as an excellent illustration of good taste in display. If the reader will imagine the bottles to be amber or yellow in color, it will give a better idea of the actual display.

No. 44.—Mr. W. S. Hart is now the oldest Florida beekeeper, having begun there in 1876. His success there has been remarkable; and although he has seldom kept over 125 colonies, he has made them count, for he has astonished the bee world by some of his yields per colony and per apiary. Mr. Hart is also well known as a grower of fine oranges.

No. 45.—Mr. G. C. Greiner is one of the most successful apiarists of New York, and a steady and interesting writer for the apicultural press. As will be seen by the picture, his apiary is destitute of shade, although planted to small trees. He has equally good results whether his hives are shaded or stand in the sun. He uses the tent shown, for his own accommodation.

No. 46.—This illustration represents the moving of four wagonloads of bees by a traction-engine in Canada. The load consisted of 110 twelve-frame hives with one or two supers on each, the racks being filled with straw. The trip of forty miles was made without accident under the management of R. F. Holtermann.

No. 47.—This view represents the gasoline-engine extracting-outfit of Virgil Sires, located on the Yakima Indian reservation, Washington. With this outfit he extracted in 1908 twenty tons of honey. At the time of writing he was inclined to think a permanent extracting-house would be cheaper than to draw this one around.

No. 48.—This scheme of an extracting-house on wheels is the best we have yet seen presented. In a series of outyards it makes it possible to use only one extractor and outfit, and to carry away the honey as soon as extracted, where it will not be liable to be stolen. While going to the several yards the men inside the wagon can slick up and get things ready for the next yard. The tank holds about 100 gallons, and in 1899 Mr. Crowder and his brother put 43 cases of honey through it in two days, which is remarkably fast work.

No. 49.—This picture shows Mr. E. M. Gibson, of Jamul, Cal., working with an extemporized wheelbarrow of his own construction. The original cost was only about 75 cents, and had performed constant service for 15 years when the picture was made. Mr. Gibson is one of the best-known of the California beekeepers.

No. 50.—This shows the apiary of Mr. J. S. Cotterell, of New Zealand, in the southern hemisphere. It is planted with peach-trees, with shelter-belts of wattle and gum trees, giving an almost constant slow flow the year round.

No. 51.—This somewhat comical way of getting bees to learn their letters was sent us by Mr. J. W. Arthur, of Springfield, Ohio. The lower word, "Nook," is a little plainer than "Cozy," above. Although similar effects have been produced many times, they are very good "catchers" at fairs and expositions, as they seem to form a sort of border line between human skill and animal intelligence.

No. 52.—This represents a winter case used by Mr. L. List, of Detroit, Mich., standing open for manipulation. The upper half of the back wall is hinged, also two-thirds of the top. The raised top is held in position by a support, hinged at both ends and in the center. The roof is covered with asphalt roofing paper.

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GOOD BEE BOOKS

Practical Works on Bees sold by The A. I. Root Co.

The books mentioned on this and the succeeding page are all devoted to practical bee culture, although a few of them, as will be noted by their descriptions, have more or less scientific value. A somewhat careful reading of the descriptions below will undoubtedly show any one just what book will suit him best. If several books are to be selected covering a wide range of subjects, the following list may be helpful in deciding what you want: "How to Keep Bees," "Langstroth on the Honeybee," "A Modern Bee-farm."

LANGSTROTH ON THE HONEY-BEE. By C. P. Dadant. The beekeeper who does not like this book is hard to suit. The present volume is termed the "Twentieth Century Edition," and contains a vast fund of information on all subjects relating to practical bee culture. It has long been recognized as a standard work, and should be found in the library of every progressive beekeeper. It is well illustrated, and has 575 pages. Price by mail, $1.25; by freight or express, 15 cts. less.

MANUAL OF THE APIARY. By Prof. A. J. Cook. This is a very complete treatise on bees and beekeeping, and is particularly valuable where one is interested in the anatomy and physiology of the bee, which has been very completely covered in this work. It is also valuable for its chapter on honey-plants, or bee botany; 540 pages with good illustrations. Price by mail, $1.15; 15 cts. less by freight or express.

DOOLITTLE'S QUEEN-REARING. This is practically the only comprehensive book on queen-rearing now in print. It is looked upon by a good many as the foundation of modern methods of raising queens wholesale. Mr. Doolittle has an entertaining way of writing on bee subjects which enables his readers to follow him with pleasure, even if they never intend to raise queens at all. Cloth bound, 124 pages, $1.00 postpaid; leatherette, 50 cts.; by freight or express, 5 cts. less.

QUINBY'S NEW BEE-KEEPING. By L. C. Root. A modern edition of that early volume on bees entitled "Quinby's Mysteries," revised by a well-known beekeeper, a son-in-law of the original writer. Mr. Quinby was a practical beekeeper, and greatly assisted Mr. Langstroth in laying the foundation of American apiculture. For this reason it should be read by all beekeepers who want to know of the early work on beekeeping. Cloth bound, 270 pages, by mail, $1.00; by freight or express, 10 cts. less.

HOW TO KEEP BEES. By Anna Botsford Comstock. This is a charmingly written manual for amateurs, describing in the clearest language all necessary details. The authoress combines enthusiasm, literary ability, and a knowledge of beekeeping in a goodly volume. Having herself made a start in the bee business, she fully appreciates the perplexities of the situation and makes provision accordingly. The book is well suited to the wants of the suburbanite who wishes a hobby which will give something by way of return for labor and capital expended, or those who wish to keep only a small apiary either for pleasure or profit. If there is any better book than this for the purpose indicated, we do not know of it. Cloth bound, 228 pages, $1.00 postpaid; by freight or express, 10 cts. less.

BIGGLE BEE-BOOK. This is a very neat cloth-bound book, well printed and illustrated. It is 5½ by 4 inches, by ⅜ inch thick—just right to carry in the pocket. It is just the thing for the busy man who would like to get a birdseye view of beekeeping, and who has not the time to read the more comprehensive works. The book is boiled down, containing only the best practices known. Price by mail, 50 cts.; 5 cents less if sent by freight or express.

A MODERN BEE-FARM, by Sam'l Simmins, is one of those books which will cause you to sit up and take notice if you are a real live beekeeper with lots of formic acid in your blood. The author is an English beekeeper of note, who not only knows and understands bee culture in his own home land, but is as well an earnest student of American apicultural methods. He is not very orthodox in his views, but his book is all the better for that, seeing he wants to take us out of the ruts. You can read the book right straight through, in the long winter evenings, as it runs along like a narrative or a novel. Cloth bound, 430 pages, 1904; price $2.00 postpaid; by freight or express, 15 cts. less.

BRITISH BEE-KEEPERS' GUIDE BOOK. By T. W. Cowan. This is the leading English work on practical beekeeping in England, and as such has had an immense sale. The work is condensed into 179 pages, handsomely bound and well illustrated. Price $1.00 by mail; by freight or express, 5 cts. less.

THE PRACTICAL BEE-GUIDE, by Digges. is, as its name implies, a guide to the beekeeping industry of Ireland. This is a closely printed, well-bound book of 220 pages with excellent illustrations on fine paper. It would be useful to any one who wishes to become acquainted with the status of beekeeping in the old land. Price $1.00 postpaid; by freight or express, 5 cts. less.

WAX CRAFT. By Thomas Wm. Cowan. No beekeeper of any pretensions can afford to be without one book on beeswax. This is the only book on the subject in English. Price by mail, $1.00; by freight or express, 5 cts. less.

FIRST LESSONS IN BEEKEEPING is the title of an old bee-book by Thos. G. Newman, newly revised by C. P. Dadant, an extensive beekeeper and an authority on bees. Price, in paper cover, 50 cts. postpaid.

Popular Works on Bee Culture.

The books listed below are for most part by writers of well-known literary ability, and are very interesting indeed, and greatly valued by beekeepers and others for their literary merit and popular style in which beekeeping is depicted. The description of each work will give a fair idea of the same, but a pamphlet giving an extended view of these and the practical books on beekeeping listed on the preceding page will be sent on application.

The Children's Story of the Bee. By S. L. Bensusan, London. This volume was written for children, and the author endeavors to tell the story of the bee before a youthful audience as completely as possible under the circumstances. It traces the life of the drones, queen, and worker from the egg to the final destiny of each, telling the story of each in a semi-fanciful entertaining way. 250 pages. Price $2.00; 10 cts. less by freight or express.

The Honey-Makers. By Miss Margaret W. Morley. This is the story of the life of the bee, told in very interesting style—how it lives, gathers honey, and all about it. While clothing the general subject with an air of poetry, it seems to be entirely within the limits of known facts while attempting to deal with them. Probably it has more to do with the curious traditions connected with bees than any other book of the kind. Price $1.50 postpaid.

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Mr. A. I. Root devoted a large part of his time during the summer of 1911 to revising the Potato Book which he wrote in collaboration with Mr. Terry 25 years ago. During the winter the eighth edition of 10,000 copies has been printed. Speaking of this valuable book and of Mr. Terry, Mr. Root recently had to say, "It will pay almost every man, woman, and child to read Terry's potato-book, no matter whether you ever did or ever will grow any potatoes or not. If you have read Terry's recent book, 'How to Keep Well and Live Long,' you will know that he is a student of nature, and a delver after God's gifts and God's secrets; and this potato-book, on every page, shows his remarkable gift. He is a philosopher of modern date; and his love for God's gifts, as well as his love for his fellow-men, shines out on every page. His studies of potatoes, it occurs to me, paved the way in his explorations in his later work in regard to how we should live and keep our health." Contains nearly 400 pages, well illustrated, paper bound, 57c each postpaid. Cloth bound, 85c each, postpaid. (Deduct 7c if ordered sent with freight or express shipment.)

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The Dollar Hen.

Every few days the friends write me, asking what poultry-book they had better purchase—which one I would recommend above all others, etc. Well, to get right down to it there is no *best* poultry-book. There are many good ones, but no one book contains *all* that is good. The one that is most emphatic against humbugs and frauds, especially costly medicines for dosing chickens, etc., is the one I have frequently referred to, "The Dollar Hen," by Milo M. Hastings.

The Dollar Hen is a real book, substantially bound —not a paper-bound pamphlet of "System," "Secrets," or "Methods," but a book worth several dollars of any poultryman's money. "The Dollar Hen" is a vast fund of valuable information that required much time, expense, and effort. Contains more than 200 pages; price postpaid $1.00 per copy.

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